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SCIENCE IN THE EUROPEAN ECONOMIC COMMUNITY:
A SELF-ASSESSMENT AND A DETAILED PLAN OF ACTION

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This report summarizes the European Economic Community's (EEC's) new scientific policy, provides the EEC Commission's assessment of the community's international position in science policy, and presents the detailed scientific and technological goals of a program for coordinating and planning future policy.

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CONTENTS

I INTRODUCTION

This chapter outlines the background leading to a new science strategy for the European Economic Community, presents the formal resolution adopted by its Council, and explains the organization of this report.

I.i. Background

As noted in Thomas C. Rozzell's article "Toward a European Research and Science Strategy," (*ESN* 37-12 [1983], pp. 455-456), the European Economic Community (EEC) has adopted an objective-based "common strategy in the field of science and technology" including a set of scientific and technical objectives for 1984 through 1987. The overall plan establishes general scientific and technical objectives (see Section I.ii.), specific goals for meeting those objectives (see Section III.ii.), and estimates of the absolute and relative amounts of money that should be devoted to each objective (see Section I.ii.). Present political and economic issues within the EEC--especially those involving its Common Agricultural Policy-- may well prevent it from allocating resources to science and technology at the levels proposed [(1)]; nonetheless, the Council's clear resolve to increase scientific and technical finances through a highly structured objective-based system is an important signal for the future. The EEC's research effort, excluding militarily supported work, is about double that of Japan and three-fourths that of the US; the policies of such a large community will have major international impact.

About three years ago the staff in the EEC's Commission began examining the state of science and technology in the EEC's 10 member states (Belgium, Denmark, France, Greece, Ireland, Italy, Luxembourg, The Netherlands, UK, West Germany); the goals were to assess where the EEC stood internationally and to recommend how to improve its standing. The study by the Commission produced in 1982 the desired assessment (see Chapter II); in consultation with leading EEC scientists, the Commission's scientific and technological programming group, under the direction of Mr. Jean Gabolde, developed the so-called "Framework Program" for coordinating and planning future policy. The first proposal for the Framework Program was presented to the EEC Council on 21 December 1982 for its 8 February 1983 meeting.

After considering the proposed Program, the Council in February "...welcomed the...objective...to encourage the integration of...research and development...to achieve...common objectives...within a strategic framework..." and "...expressed a large measure of agreement as to the necessity of increasing community research and development expenditure and its relative importance in the overall community budget...." Although the Council sought further data before it would adopt the Program formally, the EEC was clearly

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(1) *European Scientific Notes* will report on the funds actually allocated to the new program as soon as the decision is made and figures are obtained from the EEC.

on record as supporting a common centralized science/technology policy at an increased level; this was a major decision, since the EEC accounts for about one-fifth of the world's R&D expenditures.

I.ii. The Council's Resolution

The Commission provided the requested additional data and again presented the Framework Program for approval at the 25 July 1983 Council meeting. The Council made some relatively small changes in the funding of a couple of objectives but otherwise adopted the Program as proposed while leaving the determination of funds actually to be allocated until the overall EEC budget is established. The total indicated financing for the 1984-87 four-year program was 3,750,000,000 European Currency Units (in November 1983, one ECU was worth approximately $.85). The indicated figures--in millions of ECUs--for each year of the program were: 1984--835; 1985--905; 1986--970; 1987--1040. These figures reflect appreciable increases over 1983's roughly 600 million ECUs.

The official Council resolution is reproduced below as it appeared in the 4 August 1983 issue No. C208 of the Official Journal of the European Communities (OJ):

I

(Information)

COUNCIL

COUNCIL RESOLUTION

of 25 July 1983

on framework programmes for Community research, development and demonstration activities and a first framework programme 1984 to 1987

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,

Having regard to the Council resolution of 14 January 1974 on the coordination of national policies and the definition of projects of interest to the Community in the field of science and technology (1),

Having regard to proposals from the Commission in its communications to the Council dated 22 December 1982 and 20 May 1983 (2) on the framework programme 1984 to 1987,

Having regard to the opinion of the European Parliament (3),

Having regard to the opinion of the Economic and Social Committee (4),

Having regard to the opinion of the Scientific and Technical Research Committee (Crest),

Whereas Article 2 of the Treaty establishing the European Economic Community assigns to the Community the task, among others, of promoting throughout the Community a harmonious development of economic activities, a continuous and balanced expansion and an accelerated raising of the standard of living;

Whereas it is important to promote balanced scientific and technical development within the Community;

Whereas research, development and demonstration activities (R, D and D) must be accompanied by adequate dissemination of the knowledge acquired by means of these activities and by effective use of the results obtained;

Whereas, at its meetings on 9 November 1981 and 8 March and 30 June 1982, the Council affirmed the need to systemize and optimize Community action in the field of research, development and demonstration, having recognized that the strategic coherence of the Community's activities would be enhanced and the preparation and adoption of decisions in the aforementioned field would be greatly facilitated by the adoption and regular review by the Community institutions of a framework programme containing broad indications for the medium-term development of scientific and technical objectives;

Whereas, at its meeting on 8 February 1983, the Council expressed a large measure of agreement on the need to increase Community expenditure on research and development and on the proportionally larger share which should be allotted to it in the Community's overall budget, subject to further clarification of the budgetary implications;

Whereas, on 18 June 1983, the European Council adopted the Declaration concerning the development of policies and new Community action, budgetary discipline, own resources and particular problems of certain Member States;

Whereas the Commission's proposal concerning a first framework programme 1984 to 1987 seems likely to promote such a development of Community research, development and demonstration policy;

Whereas the Treaty establishing the European Community does not provide the specific powers of action required for the adoption of this resolution,

(1) OJ No C 7, 29. 1. 1974, p. 2.

(2) OJ No C 169, 29. 6. 1983, p. 11.

(3) Opinion delivered on 10 June 1983 (not yet published in the Official Journal).

(4) Opinion delivered on 1 June 1983 (not yet published in the Official Journal).

HEREBY ADOPTS THIS RESOLUTION:

Article 1

The development of a common strategy in the field of science and technology shall take place on the terms laid down in this resolution and in accordance with the Communities' other strategies and policies.

Article 2

The common strategy in the field of science and technology shall be defined in framework programmes setting out the scientific and technical objectives to be pursued at Community level together with selection criteria for Community action, relative priorities and financial indications.

These framework programmes shall be drawn up by the Commission in consultation with the Member States.

On the basis of the framework programmes, the Commission shall prepare proposals for specific research, development and demonstration activities which meet the objectives referred to in the first paragraph.

Article 3

The Council hereby approves the principle of framework programmes for periods of four years which will be reviewed at least every two years and revised if necessary.

On the basis of proposals submitted to this end by the Commission and after receiving the opinion of the European Parliament, the Council shall:

— approve the framework programmes,

— adopt, in accordance with the framework programmes approved and with the procedures instituted by the Treaties, specific decisions on the R, D and D activities of the Communities.

Article 4

The Council hereby approves the scientific and technical objectives for the period 1984 to 1987 and the selection criteria set out in Annexes I and II respectively.

The Council hereby confirms its agreement on the need to increase Community spending on R, D and D. While bearing in mind the need to frame Community policies, but awaiting the outcome of the general discussion on the Communities' resources and policies, for the time being the Council takes note of the financial indications relating to the objectives to be attained in the period 1984 to 1987 (Annex III). These indications are to serve as a guide for Commission planning and the adoption by the Council of specific R, D and D activities during that period.

These objectives and criteria, on the one hand, and these financial indications, which still have to be defined, on the other, shall constitute the elements on which implementation of the 1984 to 1987 framework programme will be based.

The planning and adoption of programmes will of course take account of financial constraints.

Article 5

In 1985 at the latest, the 1984 to 1987 framework programme will be reviewed on the basis of a Commission proposal and conclusions drawn from the experience gained from this first framework programme, with a view to evaluating its effectiveness and improving its underlying approach.

This review may result in revision of the first framework programme.

ANNEX I

Scientific and technical objectives

(1984 to 1987)

1. Promoting agricultural competitiveness:

— developing agricultural productivity and improving products:

— agriculture,

— fisheries.

2. Promoting industrial competitiveness:

   — removing and reducing barriers,

   — new techniques and products for the traditional industries,

   — new technologies.

3. Improving the management of raw materials.

4. Improving the management of energy resources:

   — developing nuclear fission energy,

   — controlled thermonuclear fusion,

   — developing renewable energy sources,

   — rational use of energy.

5. Stepping up development aid.

6. Improving living and working conditions:

   — improving safety and protecting health,

   — protecting the environment.

7. Improving the effectiveness of the Community's scientific and technical potential:

   horizontal action.

ANNEX II

Selection criteria

In general, when selecting Community activities on the basis of the scientific and technical objectives adopted, special attention should be given after assessment of their scientific and technical values to activities which contribute to the definition or implementation of Community policies.

In these fields, Community action can be justified where it presents advantages (added value) in the short, medium or long term from the point of view of efficiency and financing or from the scientific and technical point of view as compared with national activities (public or private).

More specifically, Community action can be justified in the following cases:

— research on a very large scale for which the individual Member States could not, or could only with difficulty, provide the necessary finance and personnel,

— research, the joint execution of which would offer obvious financial benefits, even after taking account of the extra costs inherent in all international cooperation,

— research which, because of the complementary nature of work being done nationally in part of a given field, enables significant results to be obtained in the Community as a whole for the case of problems whose solution requires research on a large scale, particularly geographical,

— research which helps to strengthen the cohesion of the common market and to unify the European scientific and technical area and research leading, where the need is felt, to the establishment of uniform standards.

ANNEX III

Financial indications by objectives
(1984 to 1987)

	MioECUs[1]	Percent
1. Promoting agriculture competitiveness	130	3,5
- developing agricultural productivity and improving products: agriculture	115	
fisheries	15	
2. Promoting industrial competitiveness	1060	28,2
- removing and reducing impediments	30	
- new techniques and products for the conventional industries	350	
- new technologies	680	
3. Improving the management of raw materials	80	2,1
4. Improving the management of energy resources	1770	47,2
- developing nuclear fission energy	460	
- controlled thermonuclear fusion	480	
- developing renewable energy sources	310	
- rational use of energy	520	
5. Reinforcing development aid	150	4,0
6. Improving living and working conditions	385	10,3
- improving safety and protecting health	190	
- protecting the environment	195	
7. Improving the efficacy of the Community's scientific and technical potential	85	2,3[2]
- Horizontal action	90	2,4
	3750	100,0

[1] in ECUs at 1982 constant values.

[2] corresponds to 5 percent by the end of the period.

I.iii. Structure of This Report

The bare bones of the EEC's new scientific policy have now been exposed; you need the missing tissue, however, in order to see the infant's true shape. The remainder of this report provides that tissue.

Chapter II presents the EEC Commission's assessment of the community's international position in science and technology.

Chapter III presents the detailed scientific and technological goals of the Program, along with the overall supporting arguments for its creation.

II EEC ASSESSMENT OF ITS PRESENT

This chapter contains the EEC's own analysis of its international standing in science and technology in 1982.

II.i. Background

By late 1982 the scientific and technological programming group of the EEC Commission had compiled a variety of data on the scientific and technological input and output of the 10 member states. That data was summarized in the 21 December 1982 initial proposal to the Council; the detailed analysis appeared in an appendix. The summary and detailed analysis have been merged to form the following section.

II.ii. The EEC Assessment (Verbatim)

I. THE CURRENT SITUATION - THE CHALLENGES TO BE FACED

At the start of the 1980s all industrialised countries - and thus, at various levels of intensity all Member States of the Community - are confronted with five major problems.

1. The economic crisis with its attendant inflation and unemployment

Two calculations in this respect : the number of unemployed which, within the Community has currently reached the level of 10.7 million, or 9.6 % of the active population, is likely to rise to 15 million in 1985[1].

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(1) It should be recalled here, in the context of Community enlargement, that Spain and Portugal are facing conditions as difficult as those in the 10. The source of the data given here is : EUROSTAT 6/1982 and the FAST report.

In order to get back to an unemployment rate of 2 % in 1995 it will be necessary to create about 1 million new jobs a year from now on.

2. The unstable (not to say declining) competitive capacity of the vast majority of Member States in relation to other major countries. This is as true of scientific or technological competitiveness as it is of agricultural competitiveness and industrial competitiveness. In fact the EEC's agricultural balance of trade with the rest of the world remains in deficit. Industrial competitiveness, which is already inadequate so far as advanced technology is concerned is tending to deteriorate in other, more traditional areas of production such as motor vehicles or chemicals. Finally, all national and Community level studies are in agreement as to their conclusions, which make it clear that there is a need to revive scientific and technical"creativity"within the Community.

3. The need to improve the management of energy and raw material resources

Whether for oil, natural gas, uranium or mineral resources which can be exploited in reasonable economic conditions, the Community is greatly dependent for their supply upon other countries. The Community must therefore take care to manage its own capital of primary or secondary resources with the utmost care (recycling materials, exploiting low grade ores, using techniques which economise on energy resources, renewable energy, etc.).

4. The vital need to intensify relations and cooperation with developing countries

It is as much out of a sense of solidarity with the third world as for mutual economic benefit that the Community is in a position to play a role unequalled in the world both so far as developing R,D&D within the developing countries themselves is concerned, and for building up its own R&D capacity in response to developing countries' needs.

5. To prepare society for the changes arising from, or likely to arise from the development of new technologies
(as much at local as at Community level)

Taking simply, by way of example, the consequences of developing information technology it is worth recalling that one third of all jobs in Europe will be directly affected in their nature or their function by developments in these technologies. Training, education and job sharing will be major topics for consideration by developed societies which wish to maintain and improve their living standards, social equilibrium and the quality of life.

Apart from these five major problems, which call for responses in the short and medium term, the Member States of the Community will - as the work of the FAST team has made clear - in the longer term, need to face up to and master the significant changes which can already be discerned :

- A profound rearrangement in the way service industries are organised.(1) These will, in the years to come, be of special importance and interest as factors creating employment, competitiveness and citizen participation. (It should be noted here that in 1980 the service sector already accounted for 51 % of jobs within the Community and 56 % of value added).

- The organisation and renewal of production by making use as appropriate, of new technologies, the essential bastion of new growth.

- Making optimum use of land via integrated land use management including water and natural renewable resources (by contrast there is at the moment considerable conflict between uses of land for different purposes ; industry, agronomy, urban development, transport, etc.).

- The development of the third world over and above the transfer of techniques and products (organised cooperation, exchanges, work sharing, etc.).

(1) By way of example one could cite the adaptation of transport systems to the new needs of the economy of society.

- Finally, continuous adaptation of society to technological change (the balance between work and leisure activities, urban structures, social participation in activities of public interest, the cultural impact of communication technology, etc.).

Whilst scientific development cannot, in the face of these harsh realities and prospects, guarantee economic growth, long term competitive capability or social well being, it does constitute a necessary albeit inadequate element. The contribution which the multi-purpose tool of R,D&D can make sometimes seems even to be fundamental.

Thus all developed or rapidly industrialising countries are assigning considerable resources to the support of R,D&D.

What is the European Community's position in this general picture ? What place does it hold in the international context ?

An analysis of the situation is given in a schematic manner in Annex I (which is a summary of analyses carried out by Commission staff,UNESCO, the OECD etc.) and in a more detailed way and on a sectoral basis, in the theme plans listed in Annex 2.

Thus in what follows only certain overall data are given, dealing with the Community's strengths and weaknesses in the international context.

ANALYSIS OF THE COMMUNITY'S POSITION IN THE INTERNATIONAL CONTEXT

By taking an overall view of the data available (from documents prepared by Commission staff, detailed analyses appearing in the theme plans,documents produced by UNESCO, OECD and NATO) it is possible, in a few figures and illustrations to show the Community's place in the international context as well as trends which can be forecast.

These data should be treated with caution however, since comparison can often be made difficult because of the differences of definition or nomenclature which are used in the various countries analysed and because of the significant fluctuations in exchange levels and consumer price indexes (formulae used in forecasts to compensate for these variations are obviously founded upon hypotheses).

1. The international context

In 1981, more than 200 billion ECUs were spent on R,D&D in the world (both public and private spending). More than two million research workers took part in this activity, which had a strongly intensifying effect on the stream of competition by innovation.

The United States, whilst not retaining the scientific and technical predominance which it has held for 20 years, remains the country which has the most complete research and innovation potential today, and as a general rule, the one which is most productive. Without any serious gaps or inadequacies in the research carried out it maintains an outlay of considerable size.

United States of America

1982 Federal R&D funding by agencies (estimates)

	$ Billion	Billion ECU	% Total
National Defense	19.65	19.59	51.34
Space Research and Technology	5.74	5.72	15.00
Health and Human services	3.90	3.89	10.20
Energy	4.86	4.84	12.69
Nat.resources and Environment	0.72	0.72	1.88
Transportation	0.36	0.36	0.94
Agriculture	0.84	0.84	2.21
Social services	0.51	0.51	1.33
N.S.F.	0.90	0.90	2.36
Other Agencies	0.78	0.78	2.05
TOTAL	38.28	38.15	100.00

1 ECU = $ 1.00324 (6 month average 1982)

Source : N.S.F.

Despite some downward trends which are to be seen in the growth curves of funds allocated to R&D by the Federal Government, forecasts which have been assembled show that this effort will continue in the years to come.

Total R&D expenditure in the USA (including public and private research)

Forecast expenditure expressed in billion ECU

	1982 (1 ECU = 1.00324 $)	1984	1987
R&D spending	77,38	± 94	± 116

Ratio of R&D expenditure to gross domestic product 1980 : 2,4 %

Sofar as active research workers are concerned, their number in the USA can today be estimated at ± 660,000. It might also be noted that university staff are three times greater in number here than within the Europe of 10.

It is Japan which is currently giving R,D&D investment proportionally the greatest priority. During the last decade the ratio of R&D expenditure to GDP grew from 1.5 % to 2 % (whereas the intensity of effort within the Community (EUR 10) hardly altered, remaining at about 1.9 %). It is intended that this ratio should be built up to 2.5 % in 1985 and 3 % in 1990[1].

An intense research effort linked to a clear and concentrated industrial policy has allowed Japan to acquire progressively more advanced, not to say predominant, positions in world markets such as iron and steel, shipbuilding, optics, computer science and biotechnology.

The objectives for the future have already been announced[2]. They are (apart from strengthening competitiveness in the fields of new information technologies and biotechnology) :

- materials from industrial recycling
- oceanography
- highly processed food stuffs
- housing and urban development
- medical and chirurgical materials
- and, in connection with information technologies, all equipment making it possible to economise on man power.

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(1) Report by the Science and Technology Agency of the Japanese Government (1981).

(2) Source : Ministry of International Trade and Industry, Tokyo.

So far as financial forecasts are concerned the following probable trends can be put forward :

Total R&D expenditure in Japan (including public and private research)

Forecast expenditure expressed in billion ECU

	1982	1984	1987
	(1 ECU = 244.671 Yen)		
R&D spending	± 25.26	± 30	± 41

Active research workers in 1981 totalled about 405,000 (in other words a greater number of researchers than the Community. It should be noted that the university population is already higher than in the Europe of 10).

Finally it is worth stressing the fact that R&D expenditure in Japan goes exclusively towards research for civilian purposes.

The USSR and the COMECON countries are characterised by the following features :

- considerable R&D investment (mainly in the USSR where the ratio of R&D expenditure to GNP is the highest in the world, exceeding 3 % in 1981 according to official figures),
- a concentration of effort in certain areas : military research, space, propulsion, hydroaccoustics, optics, etc. (we might also mention in the field of basic research : mathematics, theoretical physics, astronomy, nuclear physics),
- a notable inadequacy sofar as applying R&D results to problems of agricultural or industrial competitiveness is concerned, or to the exploitation of resources.

Another point worth emphasising is the immense training and education effort, particularly directed towards science and technology which is being undertaken and sustained in the COMECON countries.

The USSR and other COMECON countries thus display the dual - and contradictory - characteristics of being at one and the same time countries which are highly developed scientifically speaking whilst being dependent on the West in many fields for a lot of technology or technological applications which are economically fundamental. In this respect they are in both scientific and technological, and market terms, countries which will be of considerable interest to the Community in years to come.

China, a huge nation slowly becoming industrialised, is at the same time scientifically and technologically advanced in certain fields (space, nuclear questions, biology) and underdeveloped in various fundamental sectors. Its declared intention, which can only with great difficulty be expressed in figures, is to increase its investments in R&D on a regular basis. This should be noted with interest by the Community because of the amount and the quality of China's resources, particularly human resources.

So far as other industrialised nations are concerned (such as Canada, Sweden, Switzerland, Austria or Spain...) the data which have been collected* show a marked wish for growth in research and development.

At the same time, but within due limits, the rapidly developing countries (such as Brazil, Mexico, India and Korea...) which have recently entered the market for classic or advanced technology are making evident their intent to support R,D&D investment increasingly in various fields.

* * *

(*) See the 13 theme plans in this respect.

2. The Member States of the EEC

The national R,D&D policy confrontation exercices which have taken place among the Member States (COPOL 79 and COPOL 81[1]), and the comparisons which have been made with policy in the United States and Japan have very much brought out three groups of facts :

a) The European Community possesses a major potential for research at the threshold of the eighties viz.:

- 20 % of all money spent on R,D&D in the world (public and private research - more than 52 billion ECU in 1982),
- more than 1 million scientists and technicians (including 350,000 researchers) are currently engaged in this sort of activity),
- Europe's R&D capacity is less than half as great as the USA's (but only 27 % less if one confines the comparison to civil research), and it is double Japan's.

b) Whilst, generally speaking, the technology gap between the Europe of 10 and the USA has been significantly reduced over 15 years, new weaknesses are becoming apparent as compared to the USA and Japan. By the same token one cannot help but note the Community's inadequacies, compared to these two countries in respect of the utilisation of research results and their adoption in terms of innovation, particularly industrial innovation.

c) For the major fundamental research areas (the "big sciences") and the high technologies, European cooperation has made it possible for European States to avoid being left out of the mainstream of science and industrial innovation in fields such as high energy physics, space, aeronautics or thermo-nuclear fusion.

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(1) See the relevant documents
- CREST/1237/79
- CREST/1202/2/82 rév.2

Conversely, in fields where European cooperation has not or not yet developed, noticeable gaps are appearing between the Europe of 10, the United States and Japan (this is already evident in the case of computer science and biotechnology, and worrying signs are emerging in more traditional sectors; the automobile, chemical and materials industries).

Developments and trends

- General data

So far as budgets are concerned it may be noted that between 1970 and 1980 the total of budget appropriations for R&D (nearly 20 billion ECUs in 1980[1]) grew by one third, putting it somewhere between the stagnation of R&D budgets in the USA and the more than doubling in Japan.

As for priorities one may note the large proportion always assigned to defence, which is in

EUR 10	25 %	of public expenditure on R&D
USA	47 %	"
Japon	2 %	"

However it should be stated that the position differs very much from one country to another within the Community, and the proportion given over to defence can vary from 0 to more than 50 %.

Apart from defence the R&D policies of the Member States of the European Community are essentially based upon the following principles :

- promoting internationally competitive economic development,
- solving social problems such as improving working conditions and protecting the environment,
- maintaining a proper balance between basic research and research oriented toward practical applications.

(1) 26,5 billion in 1982.

- Sectoral data

The importance accorded to Agriculture in the Community (expressed mainly in the Common Agricultural Policy) is only partially reflected in R&D at national level. In fact one sees that public expenditure on agriculture R&D for all Member States accounts on average for only 3.7 % of the total, and that it is distributed very unevenly (Netherlands and Denmark 9 %, France 4 %, West Germany 2 %).

On the other hand Italy, where the area of land under cultivation has shrunk by 6 % over the last 10 years (compared with a Community average of 3 %), spends no more than 0.9 ECU per head of population whilst the Netherlands spends 6.8. In Ireland (which spends 4.7 ECUs per head on R&D, taking second place after the Netherlands), agriculture has a key position in the country's economy, but productivity remains somewhat low compared to other Member States.

In the industrial field intervention by national administrations is more than significant in that it accounts for 50 % in some Member States ; it is clear that developing the innovation capacity of industry has come to be one of the ways of tackling the crisis which is affecting Western economies. This realisation is relatively recent however since, following a major reduction in R&D for industrial purposes at the start of the 70s, the come back was not apparent until around 1978. Keeping up this trend made it possible to get back to 1974 levels in 1981.

Since 1974 Energy has been given a very high priority in the Community so far as financing R&D is concerned (11 % of the total R&D budget). This has largely been justified by the highly negative trade balance in energy products. However since 1974 it is noteworthy that there has been a redistribution of public finance within the overall budget devoted to energy research : nuclear fission energy has experienced a significant reduction in its share (of the order of 20 % in the Federal Republic of Germany and 7 % in France between 1975 and 1980) in favour of fossil fuels, renewable energy sources and energy saving. On the other hand,

the proportion assigned to controlled thermonuclear fusion has remained fairly high (6 % of the overall public expenditure on energy research in the Community in 1979).

After energy resources, the supply of Raw Materials is the second weak point in the Community's economy, where imports are more than double exports. Public R&D effort in the Member States to do with optimal use of raw materials and recycling them is limited however and is of the order of 7 % of public expenditure on industrial research.

Improving Living Standards is one of the basic goals of the Member States which, particularly via their R&D budgets, have given the question increasing attention during the last decade. It might be noted that from 1970 to 1979 the proportion of R&D expenditure devoted to managing the human environment, to protecting and promoting health, and to problems of life in society has grown from 7.5 % to 11.2 %. However, this trend seems to have stabilised and in 1980 a slight reduction was noticeable, in particular for the objective dealing with life in society.

Finally, international and European scientific and technical cooperation (apart from Community activities **and COST actions) is mainly concerned with :**

- basic research operations. To be noted here are mainly the European Nuclear Research Centre (CERN), the European Molecular Biology Laboratory (EMBL) operating within the framework of the European Molecular Biology Organisation, the Observatory run by the European Organisation for Astronomical Research in the Austral hemisphere (ESO) and the Global Atmospheric Research Programme (GARP). In this context it is worth noting the special role played by the European Science Foundation so far as information exchanges and the concertation of basic research activities are concerned.
- major technical research programmes. Among the main examples to be noted is the European Space Agency (ESA) which, from the financial point of view is the biggest international

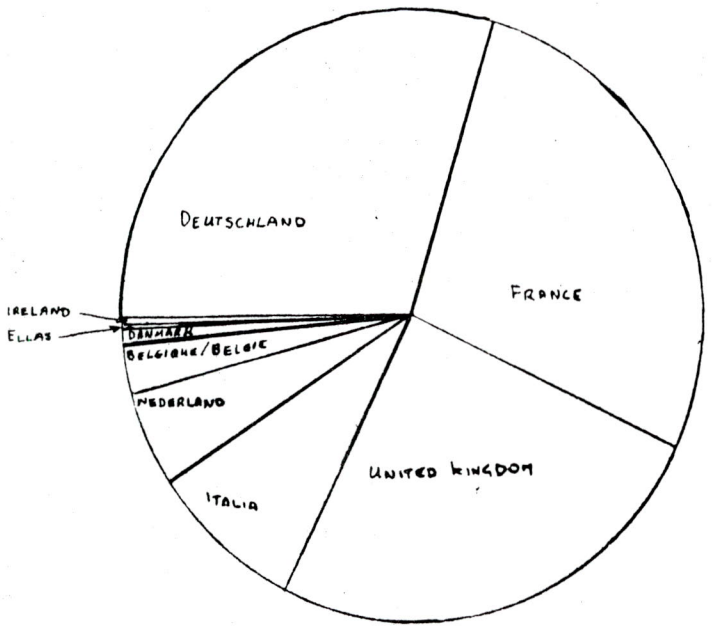
cooperation organisation in the world with a budget of 730 MioECUs in 1980 and getting on for 1.500 staff. One might also mention the EURODIF association (constructing an enrichment plant for nuclear fuels using the gaseous diffusion method), and the Airbus programme.

A last point, particularly so far as Member States R&D activities intended to support developing countries are concerned, is that France spends the most (of the order of 65 % of total Community expenditure, which was about 260 MioECUs in 1980 - a net increase over 1975 when expenditure was 200 MioECUs).

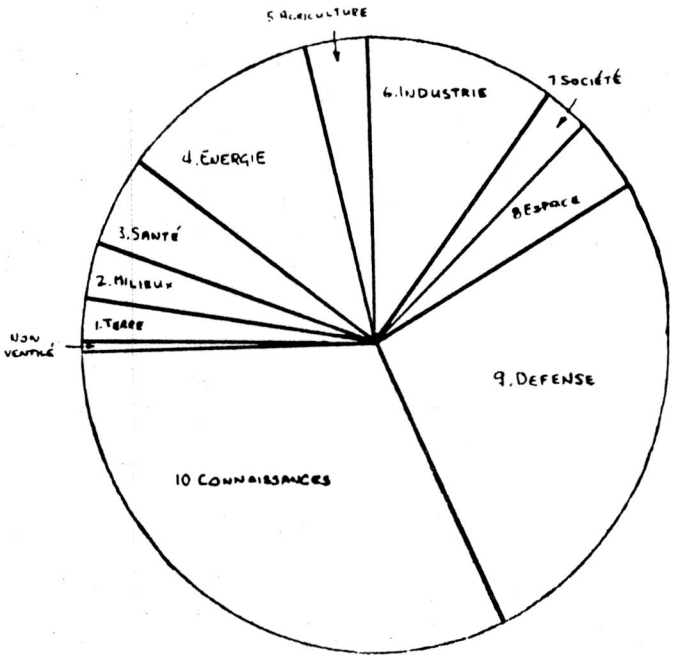
TOTAL FOR EUR-10 : 23,842.14 MioECU

1981

TOTAL FOR EUR-10 SET OUT BY COUNTRY



TOTAL FOR EUR-10 SET OUT ACCORDING TO NABS OBJECTIVES *



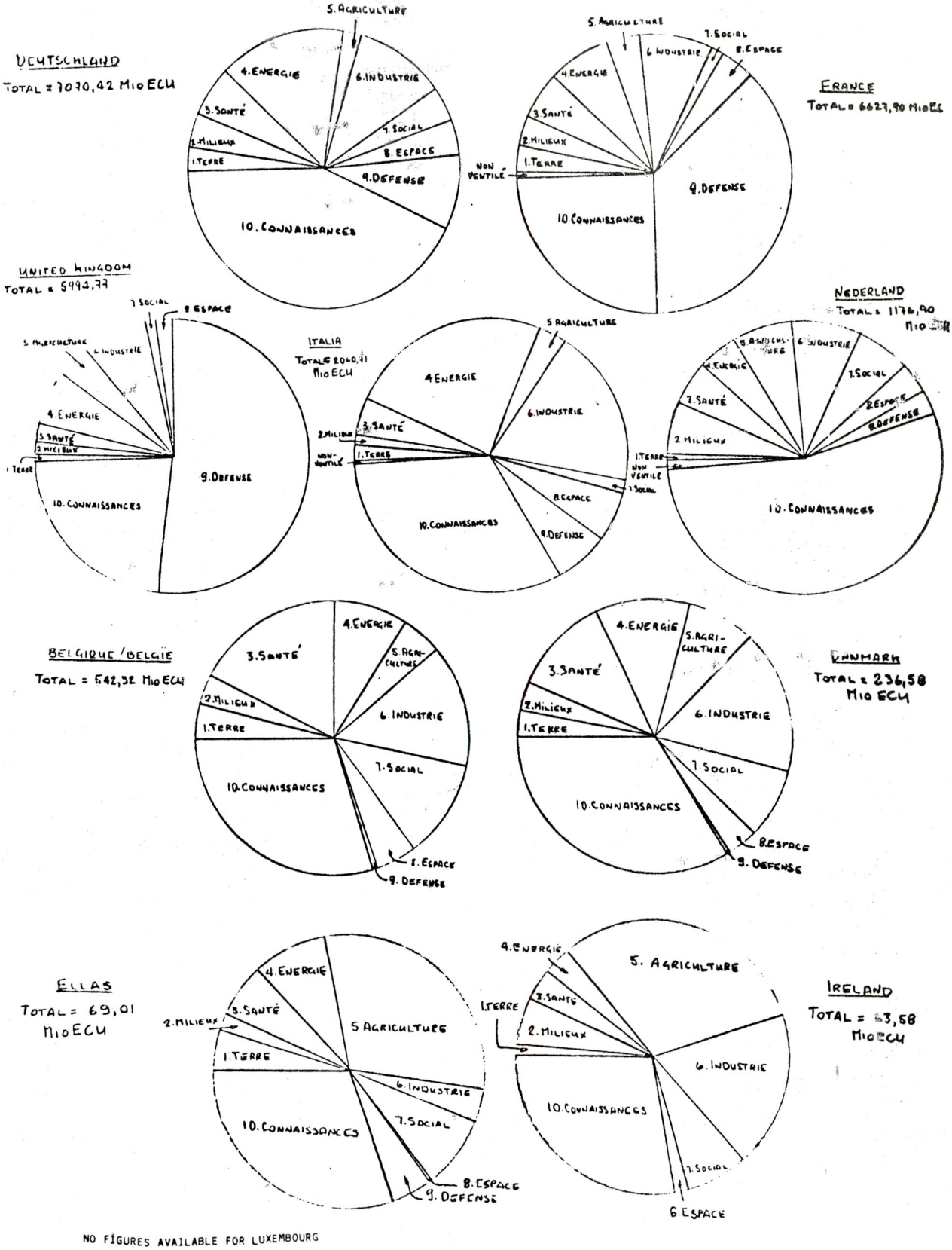
Figures for Luxembourg not available

1. Exploration and exploitation of the earth and its atmosphere
2. Planning of human environments
3. Protection and improvement of human health (of which 33 research on pollution)
4. Production, distribution and rational utilisation of energy
5. Agricultural productivity and technology

* nomenclature for analysing and comparing scientific budgets

6. Industrial productivity and technology
7. Social & sociological problems
8. Exploration & exploitation of Space
9. Defence
10. General promotion of Knowledge

RDD EXPENDITURE IN THE MEMBER STATES SET OUT ACCORDING TO THE TO NABS OBJECTIVES.



NO FIGURES AVAILABLE FOR LUXEMBOURG

Changes in public funding since 1975 are shown by the following[1] :

Budgetary allocations (Government Funding) Billions of ECUs

	1975	1981	1982 prov.
Belgique/Belgie	0.36	0.54	0.56
Danmark	0.18	0.24	0.25
Deutschland	4.18	7.07	7.84
Ellas	n.a.	0.07	0.07
France	3.18	6.63	8.17
Ireland	0.03	0.06	0.08
Italia	0.56	2.06	1.91
Nederland	0.64	1.18	1.28
United-Kingdom	2.37	5.99	6.33
EUR-10	11.50	23.85	26.49
COMPARISON			
	1ECU= $1.24077	=$1.11645	=$1.00324
U.S.A. (Federal outlays)	14.56	30.16 Est.	38.15 Est.
	1ECU=354.312YEN	=247.598Y	=244.671Y
JAPAN (Gov. expenditure)	2.49	6.83 Est.	7.50 Est.

P.S. The funding breakdown of R&D between public sector (Gov. funding) and private sector (industry, NPO, etc.) is about 50/50 for EUR-10 and U.S.A., whereas Japanese Government finances R&D activities at a level slightly inferior to 30%.

(1) Forecast information for the period 1984-1987 in the Member States of the EEC is still too uncertain to be given here.

Thus in general terms one can see that the Community's Member States possess scientific and industrial resources of remarkable breadth, richness and diversity. The personnel, the teams, the equipment, the financial resources (even if they are somewhat inadequate) the mechanisms for transforming knowledge into innovation altogether make up what amounts to a tool for progress with a potential efficay virtually without peer at the international level.

However, on a second analysis Europe's potential exhibits some worrying features. The vast majority of national and Community studies which have been carried out in recent years highlight the following realities :

- something of a decline in the creativity or scientific productivity of European research systems,
- not enough multi-disciplinary research (whereas for many areas, such as new sources of energy, the environment, agro-food, the solutions required can only be found by means of multi-sectoral of multi-disciplinary research),
- some rather large gaps in the research continuum, where universities feel work is too applied in nature but where industry feels it is too basic (namely synthetic materials, agro-food technology, toxicology, among others),
- the mismatch which can be discerned in various sectors between scientific "supply" (the product of research laboratories) and :
  - i) scientific and technical demand, particularly that arising from industry,
  - ii) social demands,
  - iii) to a lesser extent, governmental demand.

This relative mismatch between supply and demand brings about some serious lacks. The Euro-Siberian pipeline is a very good example in this respect, where the American embargo showed up Europe's level of dependence. The mismatch also leads in many cases to developments in applied research which are not actually applicable, or to the appearance of innovations for which there is no market (series of computers, aircraft prototypes, pharmaceutical products, etc.),

- the failure, or over slowness, to adapt shown by public research organisation structures (suffice it to quote in this respect the well known problem of the division of functions between research and teaching within universities, and relations between the universities and industry),
- insufficient attention is given to disseminating scientific and technical information and exploiting R,D&D results,
- finally, too much duplication of public R&D activities carried out in countries of the Community : large parts of the research funded by public money in the Member States are being developed simultaneously and are the same. Whilst in many cases such duplication may be stimulating or fruitful there is always a threshold above which repeating work becomes a sterile exercise, and above which intra Community competition develops to the detriment of the competitive capacity of the Community vis a vis other countries. And this is particularly true while the level of the teams concerned is uncompetitive in international terms. It is certainly true that for several years, so far as this last matter is concerned the number and the scope of joint activities and Community cooperation have experienced rapid growth. However, the competitive capability of the Member States remains insecure and their scientific and technical reknown uneven.

The similarity of these negative aspects within the Community, the major expenditure which is devoted to research nationally - which does not however reach the threshold of international competitiveness - the limits and inadequacies of each country, are all factors which bear witness to the necessity for systematic cooperation. But should this be bi-lateral and multi-lateral, and arranged on an ad-hoc basis, or a strategy organised and developed progressively at Community level (and brought into relations with other developed and developing countries) ?

These are the questions which the Commission is now asking Member States to discuss, using as a basis this document, which proposes a scientific and technical strategy for Europe,and its expression in the form of a framework programme for the years 1984-1987.

III EEC DETAILED OBJECTIVES AND GOALS

This chapter presents the overall arguments by the EEC Commission in favor of the Framework Program and reproduces the descriptions and justifications of the detailed goals proposed to meet the Program's objectives.

III.i. The Argument for a Framework Program

The 21 December 1982 proposal from the EEC Commission to the Council contained the following material explaining the need for a Framework Program.

> Three basic principles upon which the common strategy for 1984-1987 should be founded are suggested :
>
> - Firstly, a reinforced priority to be given to developing scientific and technical activities in the context of the redeployment of the Community's policies and activities and the allocation, in the framework of this redeployment, of an increasing percentage of human and financial resources to these activities.
>
> - Secondly, starting out from the basic goals, making use of an objective based approach, that is of a selection of well thought out and significant objectives for the period 1984-1987 with a view to :
>
> . facilitating the implementation of the research specifically desired by the Member States,
>
> . facilitating the subsequent adoption of action programmes for implementation by identifying and putting into order the priority needs of the Community and thus the relative weighting to be given to the corresponding scientific and technical objectives,
>
> . testing in a specific manner the method of making political and technical choices as between national, international and Community activities.
>
> - Thirdly, the undertaking of a sustained effort to stimulate the efficacy of the Community's scientific and technical potential. This topic, which is the seventh basic goal selected for the framework programme 1984-1987 is the subject of a separate chapter in the 2nd part of the document setting out the "programming guides".

Thus at this point only the first two basic principles proposed are considered :

1. INCREASED PRIORITY FOR SCIENTIFIC AND TECHNICAL ACTIVITY

The common R&D strategy should not have the Europeanisation of scientific and technical activities in the Member States as an aim in itself, but should aim to create and sustain the most favourable conditions for joint growth. With this joint growth is mingled a concern for improved cooperation with other developed or developing nations.

That these conditions are frequently unfulfilled at the Community level was recognised by the Member States at the Council meetings of 8 March and 30 June 1982.

To make a real choice between national, international and Community action possible, the assessment of the volume of Community efforts to be envisaged should not be limited in advance to an artificially restrained amount having very little to do with the problems to be tackled. This is in fact a question of the scale, of the significant level which should be given to Community activity.

So that discussion, and hence useful choice, can exist, it is important that one be open to the idea of significant potential growth in Community resources, at least for some goals. Otherwise the current realities of obvious imbalances, and, in fields not forming the subject of Community activity, a very costly non-Europe, can only be prolonged.
As an example, one might here make reference to thermonuclear fusion, an activity where the Member States, committed to a path involving 3 billion ECUs worth of expenditure up to 1990, have decided to coordinate all their efforts and invest 600 MioECUs jointly between now and 1986 for reasons both to do with effectiveness and economy whilst at the same time following through an examination of enlargement and cooperation at international level. It is certainly true that by no means all the subjects to be discussed will be as straightforward as this. However, the example should be kept in mind as a reference.

But even more so should it be recognised by the Community institutions that the Community's scientific and technical activities are activities which in the 1980s should be given increased priority because of the value added which they contribute to national activities by prolonging and expanding them at least cost to all.

In this respect one should recall the extent to which European cooperation efforts during the last few decades have been a determining factor for the Member States in keeping them up with competition through innovation (nuclear fission, thermonuclear fusion, space, etc.). It should also be noted that, conversely, in those fields where European cooperation has not or has not yet been developed significant gaps are appearing between the Community, the USA and Japan (already apparent so far as computer science and biotechnology are concerned, weaknesses are beginning to emerge in more traditional sectors such as motor vehicles, chemicals and materials.

By virtue of the direct value to Member States which the Community dimension possesses in itself as compared with any other form of cooperation, in terms of continuity, efficacy and economy, the efforts to be carried out jointly should systematically be pinpointed each time the usefulness of such cooperation becomes apparent.

Working from the considerable problems and needs which have been isolated in the course of preparing the current framework programme, the Commission can only state the need to accord a significantly increasing importance to scientific and technical activities in the context of the readjustment of strategies and policies which it is carrying out.

2. THE OBJECTIVES BASED APPROACH - THE MAIN SCIENTIFIC & TECHNICAL OBJECTIVES

The series of studies and consultations which were undertaken so as to prepare this framework programme particularly highlighted and confirmed :

- the similarity between the major problems faced by Member States of the Community (the economic crisis, competitiveness...),
- the large amount of duplication of research carried out (at various levels and with various degrees of funding) by the different Member States ; a factor which limits Europe's capacity to compete where this duplication has no value,

- the degree of dependence, sometimes unacceptably high, on other countries (for example vegetable protein, the American embargo upon the Euro-siberian gas pipeline, raw materials),
- the progressive worsening of North/North and North/South imbalances,
- the discrepancy or mismatch between scientific supply, that is the products of research, and economic and social demand.

Thus, since any strategy must be a response, the Commission, in confirmation and as a clarification of its previous communications, is now putting forward the following basic goals and major scientific and technical objectives for the first framework programme 1984-1987 :

COMMUNITY GOALS	SCIENTIFIC AND TECHNICAL OBJECTIVES	
1.Promoting agricultural competitiveness (including fish)	1.1.Development of agricultural competitiveness and improvement of products	
2.Promoting industrial competitiveness	2.1.Elimination and reduction of hindrances	
	2.2.Improvement & develp.of new techniques and products for conventional industry	
	2.3.Promotion & develop.of new technol.	2.3.1. Information technology
		2.3.2. Biotechnology
3.Improving the management of raw materials	3.1.Optimal use of raw materials (including recycling them)	
4.Improving the management of energy resources & reducing energy dependence	4.1.The develop.of nuclear fission energy, esp. safety aspects	
	4.2.Controlled thermonuclear fusion (JET)	
	4.3.The develp.of renewable sources of energy	
	4.4.Rational use of energy (analysis of systems, hydrocarbons,coal,energy saving)	
5.Reinforcing development aid	5.1.The implementation of S/T activities which benefit developing countries	
6.Improving living and working conditions	6.1.Improvement of safety and protection of health	
	6.2.Protection of the environment (and prevention of hazards)	
7. Improving the efficacy of the EEC's S/T potential (Stimulation)		

So that one may better understand the programming guide which is to be selected for the 1984-1987 period - as a function of the goals and of the objectives - it is first necessary to analyse the scientific and technical choices which the Community has made up to now.

The scientific and technical choices currently facing the Community

The adoption of this matrix system of describing the Community's current scientific and technical (R,D&D) activities makes it clear that the choices which have been made up to now, in a pragmatic and sectorial manner,can be expressed in financial terms (for 1982) as follows :

(The table below was made by analysing all the sectoral programmes which have been developed up to now and specifying which goals they correspond to either in whole or in part. Thus the objectives are set out horizontally and the sectors vertically).

SCIENTIFIC AND TECHNOLOGICAL ACTIVITIES

BUDGETARY ALLOCATIONS FOR 1982
(Commitments)

Expressed in MioECUS

COMMUNITY GOALS	SCIENTIFIC AND TECHNICAL OBJECTIVES	ACTIVITY SECTOR	Agricult. Fish	INDUSTRY	Transport	Raw materials	ENERGY	DEVELOPMENT	SOCIAL	ENVIRONMENT	GENERAL INT.ACTIV.	TOTAL	% BY OBJECTIVE	% BY GOAL
			Agricult. Fish	new technologies (biotechnology, information technol. microelectronics remote sensing) conventional technologies (steel textiles, shoes, food stuffs) Community Bureau of References		metals uranium ceramics wood recycling substitute materials	energy savings hydrocarbons coal controlled thermonuclear fusion JET new sources of energy nuclear fission	research for the benefit of developing countries LOME	research into medecine and public health hygiene and mine safety radiation protection	protection of the environment				
1. promoting agricultural competitiveness (including fish)	1.1. Development of agricultural competitiveness and improvement of products		4,52	4,08	-	0,20	1,84	-	-	0,12	0,24	11,00	1,86	1,86
2. promoting industrial competitiveness	2.1. Elimination and reduction of Hindrances		0,43	0,92	-	-	2,76	-	-	-	0,24	4,35	0,74	18,46
	2.2. Improvements & devt. of new techniques & prod. for Convent. Industries		-	23,14	-	3,01	20,12	-	0,42	3,06	0,24	49,99	8,47	
	2.3. promotion & development of new technologies	2.3.1. Info Technology	-	52,57	-	-	0,10	-	-	-	-	52,67	8,92	
		2.3.2. biotechnology	-	0,75	-	0,28	0,92	-	-	-	-	1,95	0,33	
3. Improving the management of raw materials	3.1. optimal use of raw materials (including recycling them)		0,05	1,27	-	6,11	0,15	-	-	0,42	-	8,00	1,36	1,36
4. Improving the management of energy resources & reducing energy dependance	4.1. the development of nuclear fission energy esp. safety aspects		-	-	-	0,91	111,79	-	1,53		0,12	114,35	19,37	63,66
	4.2. Controlled thermonuclear fusion (JET		-	-	-	-	179,47	-	-	-	-	179,47	30,41	
	4.3. The devt. of renewable sour. energy		-	-	-	0,10	21,22	-	-	-	-	21,32	3,62	
	4.4. rational use of energy (analysis of systems, hydrocarbons, coal, energy saving)		-	3,04	-	0,73	53,86	-	-	1,99	0,96	60,58	10,26	
5. Reinforcing development aid	5.1. the implementation of S/T activities which benefit devel. countries		-	1,61	-	0,23	1,02	0,80	-	0,06	0,24	3,96	0,67	0,67
6. Improving living and working conditions	6.1. improvement of safety & protection of health		-	0,10	1,70	0,06	6,77	-	14,10	9,39	0,12	32,24	5,46	10,15
	6.2. Protection of the environment (& prevention of hazards)		-	2,00	-	0,83	3,00	-	3,73	17,88	0,24	27,68	4,69	
7. Improving the efficacy of the EEC's S/T potential (stimula.			-	-	-	-	-	-	-	-	-	-	-	-
Horizontal activities (FAST, Formation, Studies)			-	-	-	-	-	-	-	-	22,68	22,68	3,84	3,84
TOTAL			5,00	89,48	1,70	12,46	403,02	0,80	19,78	32,92	25,08	590,25	100,00	100
% by activity sector			0,85	15,16	0,29	2,11	68,28	0,14	3,35	5,58	4,25	100,00		

Taking the choices which have been made up to now objective by objective reveals the following :

- a pronounced bias towards improving and managing energy resources :
  - this goal takes 63.66 % of Community resources
- a rather limited priority for industrial competitiveness :
  - this goal is accorded 18.46 % of Community resources
- a fairly high priority in favour of improving living and working conditions (health, safety, environment) :
  - this goal receives 10.15 % of Community resources
- a beginning has been made in efforts to improve the management of raw materials resources :
  - this goal receives 1.36 % of Community resources
- a rather low priority for promoting agricultural competitiveness :
  - this goal receives 1.86 % of Community resources
- an almost total absence up to now of activities for developing countries :
  - this goal receives 0.67 % of Community resources.

The total amount of financial resources (including all R,D&D activities) had reached the level of 590 MioECUs by 1982, representing 2.6 % of the Community's overall budget, or again 2.2 % of the total equivalent public expenditure in the Member States.

The question is <u>whether</u> the scientific and technological activities which have been built up at Community level <u>are of adequate scope in the general context of the diverse activities and policies carried out by the Community</u>.

Can the choices which have been made up to now be considered both adequate and appropriate in relation to the challenges which the Community must face up to in the 1980s (agricultural and industrial competitiveness and employment, better balanced regional development, the emergence of new technologies, the strengthening of links with developing countries which is needed...) ?

It is clear to the Commission that the scale of the effort undertaken, and the choices which have been made so far must be reconsidered. At the same time the amount of resources allocated to each goal should be looked at again, and the relative weighting to be accorded to each of the objectives adopted should be established.

III.ii. Detailed Goals

The 21 December 1982 proposal from the EEC Commission to the Council contained detailed explanations of the specific goals that were to support the overall objectives of the Framework Program. This material was developed in consultation with experts as indicated below:

COMMUNITY GOALS	SCIENTIFIC AND TECHNOLOGICAL OBJECTIVES	NAME OF EXPERT
1. Promoting agricultural competitivenss (including fishing)	1.1. Developing agricultural productivity (soils, animal and plant products, agricultural technology)	Agricultural section : Prof. W.F. Raymond,Agricultura Science Consultant, Maidenhead UK.
	1.2. Improving the quality and processing of agricultural products	Fishing section : Dr. S.F. De Groot, Ministerie van Landbouw en Visserij, Rijksinstituut voor Visserijonderzoek, NL
2. Promoting industrial competitiveness	2.1. Removing and reducing impediments 2.2. Improving conventional techniques and products	Dr. U. Colombo, President ENEA, I
	2.3. Promoting and developing new technologies	
	2.3.1. Information technology	Mr.A. Danzin, former Director of the Institut de Recherche en Informatique (IRIA) F
	2.3.2. Biotechnology	Mr. M. Cantley,DG XII, FAST Dr. K. Sargeant, DG XII,FAST
3. Improving the management of raw materials	3.1. Optimum use of raw materials (including recycling)	Commission departments
4. Improving the management of energy resources and reducing energy dependence	4.1. Developing nuclear fission energy (in particular its safety aspects)	Prof.Dr.A.Birkhofer, Gesellschaft für Reaktorsicherheit GmbH (GRS), D Mr. A. Gauvenet, Inspecteur général d'EDF pour la sûreté et la sécurité nucléaire,F
	4.2. Controlled thermonuclear fusion, JET	(File of the Fusion Panel)
	4.3. Developing new sources of energy 4.4. Optimul use of fossil fuels (hydrocarbons, coal) 4.5. Energy savings	Prof. H. Durand, Université de Paris,F (former President of the Commissariat à l'Energie Solaire (COMES),F)
5. Reinforcing development aid	5.1. Setting up scientific and technical activities of benefit to developing countries	Mr. D. Williams,Crown Agent for Overseas Government and Administration, UK, Member of the Economic and Social Committee
6. Improving living and working conditions	6.1. Improving safety 6.2. Protecting health	Prof.L.Donato,CNR, Pise
	6.3. Protecting the surroundings (environment and prevention of health hazards)	Dr.A. Sors, DG XII, Environment Programme (Former Deputy Director of the Monitoring Assessment Research Centre, Chelsea College,University of London).
7. Improving the efficacy of the EEC's scientific and technical potential (stimulation)		Commission departments with the assistance of Special Advisors

The resulting report on goals is reproduced below as presented by the Commission:

B. PROGRAMMING GUIDE

Introduction

On the basis of the Community's chosen goals and the major scientific and technical objectives which have been identified[1] eminent people from the worlds of science and industry[2] were given by the Commission the task of preparing the theme plans. These plans make a study, once having restated the common policies which underlie the R,D&D activities, of :

- the scale of R,D&D in the field under discussion,
- the direction taken by other main countries, by the Member States and by the Community,
- the nature and the scope of the efforts which it would be desirable to develop at the European level,
- the objectives which Community activity should pursue.

These documents, together with the results of consultation with Government experts and the work of the Commission staff, served as a basis for the Commission's deliberations, prior to selecting the programming guide now put forward. Finally, three fundamental considerations served as a guide to the Commissions's thinking.

a) In the present period of budgetary restriction, the research development & demonstration activity to be undertaken in common should :
   - make it possible for Member States to exploit to the full the advantages proffered by the Community dimension,
   - achieve, through cost sharing, a significant level of activity corresponding to the scale of problems to be resolved,
   - be financed from available Community budgetary resources, particularly by using existing funds. In fact, the various Community policies should have a direct involvement with this overall strategy, which is a basic element in the development of Community science and technology.

(1) See : doc. SEC/82/310 (preparation note for the Council of 8.3.82): Framework programme for the Community's S/T activities, and doc. SEC/82/896final (Commission working paper) : Framework programme for the Community's S/T activities - First outline.
(2) See Annex II.

b) The following criteria should be adopted as a means of selecting the specific research, development and demonstration objectives :

- those S/T objectives which, because of the scale of human and financial resources which they require, cannot be carried out on a national basis, at least not without great difficulty,
- those S/T objectives whose fulfilment calls for a very large or organised market,
- those S/T objectives which, to be fulfilled, require the development of activities which are, by their nature, international,
- those S/T objectives which are responses to identical or similar collective needs within the Member States and which could therefore be undertaken at least cost,
- those S/T objectives to be adopted in order to contribute to the implementation or definition of other Community policies.

The simultaneous examination of the proposed major objectives and selection criteria during Community level discussion, will make it possible over and above the direct matching of goals, objectives and hence actions to be undertaken :

- to seek an overall balance between the various R,D&D activities to be carried out, as a function of the occasionally divergent interests of Member States (either at national or regional level),
- to take account of activities with a joint interest which might not require the participation of all Member States,
- to seek agreement or consensus insofar as the development, adaptation, rounding off or taking up of international action outside the Community is concerned : for example space research, oceanography, meteorology, COST activities and activities to be undertaken following the discussions held by the "Technology, growth and employment Working Group" set up at the Versailles summit.

c) The objectives and selection criteria proposed to the Community for the years 1984-1987 should, when it comes to selecting the actual activities which are to be implemented, increasingly pave the way for a more future oriented choice. This will therefore be deliberately angled towards the adaptation of European societies to the scientific, economic and social changes which may be foreseen in the longer term[1].

The Commission has been persuaded to adopt a step by step approach because of the discrepancies which are currently evident, and because responses from Member States are often too late or too little, given the ever increasing competition or the damaging effects of technological growth.

Thus, since the 1984-1987 period will both precede and lay down the basis for the action strategy which will need to be carried out in the 1990s, the first thing it calls for is the gradual implementation of a strategy of adaptation, to reorientate, develop and complement the Community's current activities, carried out on the basis of the three Treaties.
The main themes adopted by the Commission for this first framework programme are therefore to use the avenues of R,D&D to tackle competition from outside the Community and no longer just to maintain competition which is essentially within the Community, and to strengthen inter Member State solidarity through the choice of joint objectives.

(1) The work of the FAST team.

General remarks

- This proposal for a framework programme is the first of its kind and, for this reason represents the first stage of the continuous examination and overall decision making required by the Community institutions for scientific and technical matters.

  Based as it is upon data which are sometimes incomplete or unconfirmed it necessarily includes some faults and weaknesses.

  This instrument is one which must be brought to perfection during the years to come, particularly insofar as data collection improves. It is upon the quality of the basic national and international data which are collected that the realism and precision of the discussion over the choice to be made between national and Community scientific and technical activities depends.

- Already both numerous and varied (even if they are frequently on a somewhat modest scale), the activities which are being carried out on the basis of the three Treaties constitute a portfolio of programmes which must be integrated, with adjustments where necessary, into the new strategy which is proposed.

- The seven main Community goals are taken up one after the other in what follows, and set out according to the major objectives which have been identified. During the preparation of this programming guide account has been taken of the overlaps between objectives, disciplines and technologies which are inevitable. The relative weighting to be given to the specific R,D&D objectives under consideration for each main objective is to be found in the text relating to the various goals. Since the cost of research varies according to sector (depending for example upon whether it is research on nuclear safety carried out in large installations, or research of the systems analysis variety) and according to the operational arrangements involved (whether these involve concerted action, coordinated action, shared cost action, direct action or demonstration projects) the percentages for each of the specific objectives proposed have been allocated with these considerations in mind.

- Finally, it should be noted that the demonstration projects included in the current framework programme pursue economic and commercial objectives over and above the purely scientific and technical goals set out in the programming guide, because among other things they have to fulfil the following two conditions : "to have prospects for commercial utilisation and present difficulties over finance because of the major economic risk which such projects involve".

B-1 THE GOALS

1. PROMOTING AGRICULTURAL COMPETITIVENESS (INCLUDING FISHING)

For often very similar reasons, it is today necessary for both farming and fishing to adapt to increasingly difficult operating conditions.

The current economic difficulties facing agriculture have highlighted the risks of a policy based essentially on increasingly intensive production.

This approach has by now brought about the conditions for its own downfall : for almost all the main products the Community has reached the production level needed to meet its own requirements and this is resulting in high costs for the common agricultural policy.

The increase in fuel and power prices and rising production costs in general are making operating conditions more and more precarious for the less efficient farms.

These challenges can partially be met by adapting production structures and improving productivity aims to which research must make its contribution.

Fishing is not only affected by the cost of fuel, which pushes up product prices, but is also suffering from the loss of fishing rights in the waters of non-member countries and the introduction of conservation measures in Community waters.

Here too structural changes and technical improvements are essential despite the difficult problems involved in adjusting the sector to the new fishing conditions, and research can provide a powerful stimulus.

1.1. DEVELOPING AGRICULTURAL PRODUCTIVITY AND IMPROVING THE QUALITY OF AGRICULTURAL PRODUCTS

ROLE OF AGRICULTURAL RESEARCH IN THE COMMUNITY

The agrifoodstuffs sector is a key branch of the European economy. The importance of the CAP and its impact on the financial resources available to the Community for all its policies - more than 70% of the budget goes to

support agricultural prices - have been stressed on manv occasions. On the consumer side, about 30% of total household spending goes to buy food.

The research projects must obviously be in line with the overall approach of the common agricultural policy and must therefore fit in with its main goals. More specifically, they should help to :

- reduce disparities between the incomes of farm and other workers and also disparities within the sector resulting from production conditions; the latter, which obviously influence productivity, themselves depend on farm structures (size and equipment) and environmental factors (climate, type of soil, infrastructure, etc.);

- improve farm profitability not by increasing production where there are already surpluses but rather by cutting costs and changing over to different enterprises that will also help to reduce surpluses;

- allay the concern amongst consumers about food quality, stock farming and fattening methods, pollution of agricultural origin, the environment, etc.

The agricultural research conducted by the Member States in existing research institutes and centres has reached a very high standard. Inadequate coordination is a major shortcoming.

SPECIFIC OBJECTIVES

The current level of Community support for agricultural research is inadequate and the 1984-87 framework programme of Community activities proposes that it should be more than doubled. The order in which the specific objectives are set out below, should not be interpreted as an order of priority.

1. Better use of waste and byproducts - biomass production

This research objective is important because it helps to improve farm competitiveness by reducing inputs in the form of fertilizers, energy and animal feedingstuffs. More efficient use of farm waste would also help to reduce surface water and air pollution (see environmental protection objective).

The Community must make more effort to coordinate national programmes and to support work on technologies introducing new applications of

waste : anaerobic fermentation, various uses of straw, protein production from animal waste, use of slaughterhouse waste, composting, etc.

The use of biomass to produce energy has attracted interest in the Community, resulting in extensive biomass sections in the Commission's solar energy programmes (shared-cost projects, demonstration projects). However, two comments are called for on this approach viewed from the angle of the competitiveness of agricultural production :

a) The use of waste to produce energy on the farm helps to cut energy costs for various products and therefore this objective merits support.

b) The production of biomass (fuel crops such as fast-growing plants) is controversial, however, because it is regarded as important from the energy viewpoint but has no priority for agriculture. To produce biomass on a significant scale, would take substantial resources, especially in terms of the acreage to be put down. In any case, opinions differ on the relative profitability of the potential uses of biomass for energy, food or as a raw material (for example, in the chemical industry, which could better exploit the complex molecular structure of plants).

It would therefore be useful if the Community were to help devise methods for evaluating objectively the advantages of biomass production and use, based on a clear terminology and good tools for computing economic yields, so that the various possible applications of biomass could be compared.

2. Improvement of agriculture in marginal regions[1] (in particular Mediterranean regions)

One of the objectives here would be the better integration of agriculture in other regional activities (integrated rural development). This project could benefit from pilot and demonstration projects supported by the Community.

A data base containing objective information on land use and potential, natural risks and their ecological characterisation should be established and agricultural warning and forecasting services set up. Advanced technologies such as remote sensing could play an important part.

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1 Within the meaning of the Council Directive of 24 June 1980 Amending Directive 75/268/EEC on mountain and hill farming and farming in certain less-favoured areas.

Reclamation of derelict land for reafforestation and more generally the improved exploitation of timber resources by selection of new forest varieties should be given Community support way of research and demonstration projects.

3. Crops in deficit

The Community imports large quantities of products such as maize, tobacco, and high-protein animal feedingstuffs. Community support for work designed to encourage the growing of these products is justified, especially for economic studies on the effect of replacing traditional crops by crops that will make up shortfalls.

4. Reduction of surpluses

After each harvest the Community is faced with the problem of surpluses that are structural rather than cyclical. Research is needed to overcome this problem either by reducing production and marketing costs so that the surpluses can be sold at competitive prices on the world market, or by processing them into products for which there is a more profitable market or by converting to other purposes, (in particular the crops in deficit mentioned above) the land, machinery, etc. used to grow them. The research needed for these three approaches to the problem will be closely linked to other activities with an agricultural, agri-food or agri-industrial aspect : biomolecular engineering, remote sensing, wood, biomass for energy, research for the benefit of developing countries, etc.

Much of the effort should be devoted to demonstration projects, especially on changing land use, cropping techniques and products, the socioeconomic aspects of which should be given particular attention.

5. Food quality (research on the effects of intensive farming)

Consumers are becoming more and more concerned about food quality, which is influenced by modern methods of intensive farming, and the Community should make a major research effort in this field. In view of the complexity and economic impact of this subject, it should be studied at Community level within the general context of the common agricultural policy.

The Community should also help to develop new toxicological methods

allowing better definition of the "safety" criteria for foodstuffs.

Improvement of food processing is also an objective to be pursued. There are already coordinated COST projects on this subject. A better defined and more extensive Community effort should be made.

6. Improvement of animal production

In this area a Community impulse could make a contribution to the stimulation and improved coordination of the work of the Member States on

- control of diseases affecting young animals
- improvement of livestock breeding yields
- carcasse classification (with a view to better transparency in meat price formation)
- the development of more acceptable methods for the housing, transport and slaughter of animals (animal welfare).

7. Biological control and integrated control of diseases and pests

This covers disease prevention and pest control. Obviously research is being conducted in all the Member States to reduce productivity losses caused by the various pests and diseases affecting plants and animals. This work must be better coordinated. It also helps to reduce pollution hazards.

The Community action should in particular involve a few pilot demonstration projects on integrated control.

Protection against imported exotic diseases should form part of this objective. The research results would be useful in improving regulations on plant and animal imports.

8. Development and application of advanced methodologies

Selective Community action is required to achieve better coordination of work in the Member States, to disseminate knowledge, encourage mobility of research workers and support research in certain critical or highly specialized fields such as genetic manipulation and the protection of genetic resources (see the biotechnology objective) or remote sensing for agriculture (evaluation of yields, irrigation water management, decisions on crops and monitoring of their state).

In the genetic field, the usefulness of gene banks in protecting cultivated plant species and improving their resistance to diesase is recognized by all the Member States. There are national banks but they need to be integrated into a European system. The Community should also examine the feasibility and usefulness of gene banks for productive livestock.

9. Information

Research teams working on a wide variety of topics are scattered throughout the Member States and closer coordination of the work would be extremely helpful. For this, it is essential to improve the Community arrangements for information on current or planned research projects. An information network based on the AGREP (Permanent Inventory of the Agricultural Research Projects of the European Community), which should be updated and supplemented by data on project resources, would be extremely valuable. Community support is required to set it up, in particular to encourage information activities in some of the Member States so as to have a complete network.

Remarks

Agricultural research in support of aid to developing countries is covered in another section of the framework programme (see "Reinforcing development aid") which deals with the importance of and desirable guidelines for agricultural research for the benefit of the developing countries. This research should preferably be conducted in collaboration with research institutes in the developing countries.

Many of the items above contain an environmental element : the preservation of the natural environment and wild life must be taken into consideration (see the objective "Protecting the environment").

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1.2. DEVELOPING THE PRODUCTIVITY AND IMPROVING THE QUALITY AND PROCESSING OF FISHERY PRODUCTS

INTRODUCTION

Fisheries research is one of the essential factors for a structural policy in this sector. So far Community support for this research has been confined to a few concerted action projects of limited scope and the setting up of a Scientific and Technical Committee for Fisheries (Commission Decision of 8 June 1979 (OJ No L 156/29)) to advise the Commission. Amongst the proposals relating to structural policy in the fisheries sector set out in a communication to the Council (COM(80)420 final of 18 July 1980), the Commission proposes a Regulation concerning the coordination and promotion of fisheries research which contains information on the choice of fields in which research should be coordinated. This document is still topical and therefore the proposed subjects are taken up again below. Further suggestions and new lines of research resulting from recent development in the sector will be added to them.

SPECIFIC OBJECTIVES

The priority objectives of future Community projects should come under five general headings :

1. Evaluation of resources

This is a
This is a field which is already reasonably well covered by routine work in the Member States designed to monitor all species of commercial value. However, it would be useful to coordinate this work at Community level and support its development along the following lines :

- Bioeconomic modelling of resources. In this field a policy of aid for exchanges of scientists from the Member States and international organizations, especially ICES (except for the Mediterranean), and contacts outside the Community (United States, Canada) would be particularly useful.

- Development of methods for monitoring and evaluation of resources. In view of the high cost and limited number of laboratory ships, adequate monitoring by national facilities is impossible. Joint action is essential here to cover vast expanses of ocean including little-known regions (for example the South Atlantic).

  In the technical improvement of methods, emphasis should be placed on new methods of echo sounding and tagging for certain species.

2. Fishing and selective catching techniques

Energy saving in fishing and fish processing methods. This subject is well covered by Member State programmes but Community coordination is necessary for technical and economic studies on the improvement of fishing gear (especially trawls) and minimization of energy consumption, and on advanced techniques that save energy in fish processing and preservation. See the objective "Rational utilization of energy".

3. Product processing

The improvement of product processing techniques (e.g. refrigeration) merits Community support and should have a spinoff affecting food quality and energy conservation.

The use of small fish (for example Mediterranean pelagic fish), fishery by-products and waste could yield an as yet unexploited source of protein for human and animal consumption. A Community research project on this subject is recommended.

4. Interaction between species and their environment

The study of complex interactions between the various species and the environment is a field in which little research has been done and coordinated action at Community and international level would be very useful.

Community action is particularly desirable in the general field of contamination affecting the human food chain.

Such research would go beyond the present stage which consists mainly of devising and implementing routine analysis methods for monitoring marine pollution, and would pay greater attention to the relations between pollution and diseases carried by fish coming from polluted areas.

5. Aquaculture

This growth sector merits special attention. The major topical subjects include improvement of the reproduction of species, genetic manipulation and the study of diseases affecting aquaculture.

GOAL 1 : PROMOTING AGRICULTURAL COMPETITIVENESS, INCLUDING FISHING

Approximate breakdown between the specific objectives.

Developing agricultural productivity and improving the quality and processing of agricultural products

Specific objectives	%
- Waste (including biomass)	20
- Marginal regions	10
- Crops in deficit	5
- Reduction of surpluses	15
- Food quality	10
- Improvement of animal production	15
- Biological and integrated control of diseases and pests	10
- Development and applications of advanced methodologies	15
- Information	< 3

Fisheries

Specific objectives	%
- Evaluation of stocks	35
- Fishing techniques	15
- Product processing techniques	15
- Environment (diseases in the natural environment, pollution, etc.)	15
- Aquaculture (including diseases in artificial environments)	20

To achieve the minimum level of effectiveness required, expenditure on projects under the goal "Promoting agricultural competitiveness, including fishing" should be 130 million ECU (in constant 1982 values) for the period 1984-87, broken down as follows :

Agriculture 115 million ECU
Fisheries 15 million ECU.

For this goal, the Commission will as far as possible make use of the budget resources of the funds in this sector to finance the R&D directly related to it.

Later addendum on:

Goal n°1. "Promoting agricultural competitiveness (including fisheries)" 130 MioECUs

In its proposal the Commission wanted to underline the importance attached to this goal by providing for a tripling, in absolute terms, of the amount of research expenditure devoted to objectives linked to the promotion of agricultural competitiveness. This approach marks the first stage of a strengthening in the objectives related to this goal. During discussion in bodies responsible to the Council, some delegations suggested an even greater expenditure. The Commission, bearing in mind the importance of Common Agricultural Policy, has considerable sympathy for this point of view. However, it would draw Member States' attention to the fact that any increases for this goal would change the overall balance proposed and would therefore require a new assessment.

Since most Member States welcomed the overall balance, the Commission would, subject to further discussion in the Council, retain its original proposal which in itself significantly shows the renewed importance attached to agricultural competitiveness.

The adoption of the common fisheries policy underlines the importance of an increased R,D&D effort in order to improve the benefit to the Community of the renewable ressources of the sea.

Community R&D should be concentrated on the main objectives identified in the programming guide - section 1.2 - "Developing the productivity and improving the quality and processing of fishery products" of document COM/82/865 final.

2. PROMOTING INDUSTRIAL COMPETITIVENESS

INTRODUCTION

The need for a Community industrial strategy, the importance of R,D&D in this strategy and the priority to be given to the goal "Promoting industrial competitiveness" in the planning of Community scientific and technical activities were pointed out in two recent communications from the Commission to the Council.[1]

The rapid development of new technologies and their inevitable introduction into the industrial fabric will bring about radical changes not only in manufacturing processes but also in the nature of products and services, and the structure, organization and location of industrial activities. It is essential to anticipate these changes if industry is to be able to adapt quickly enough and become more competitive rather than being outdone by more efficient competitors and, forced on to the defensive, being obliged to protect itself by adapting when it is too late. It is primarily up to industry to make the necessary effort, but where it can be useful, depending on the economic, social and strategic importance of the sectors concerne, the Commission can and must play an important role in this process, in harmony with national measures and in consultation with industrial operators, including the small and medium enterprises.

The Community strategy stemming from the need for a long-term policy of industrial change must centre on observation and forward studies, R&D and pilot or demonstration operations :

- Observation and forward studies

  It is strategically important to investigate ways in which traditional sectors can make best use of the new technologies so as to improve, if not change, their infratechnology.[2]

- Research and development

  Infratechnology modernization calls for increased knowledge at three levels :

  . the new technologies that have enormous potential for change. Priority will be given to new information technology which has already started to revolutionize numerous economic sectors and in which an enormous effort is required, and to biotechnology which will have

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1 COM(81)639 final/2 - "A Community Strategy to Develop Europe's Industry". COM(81)574 final - "Scientific and Technical Research and the European Community-Proposals for the 1980s".

2 Infratechnology : all the technologies underlying a sector or a product.

a substantial impact on many economic sectors, in particular agriculture, health, the chemical industry and the environment;

. multisectoral technologies, i.e., key technologies common to numerous sectors;

. adaptation of convergent technologies (such as materials, design and manufacturing technologies) to specific sectors;

- Pilot or demonstration operations on infratechnology modernization

In some industrial branches or sectors of importance to the European economy and likely to undergo interesting changes within the fairly near future, it may be necessary to take measures to overcome reluctance to change. These specific measures should concern companies spread over several Member States and of different sizes, in order to benefit from the diversity of the experiments.

The promotion of industrial competitiveness is perhaps the most complex goal in this framework programme, touching as it does upon almost the whole of the production process. Community R,D&D cannot of course cover all sectors but it must, through its catalytic effect, act as a spur for measures by the Member States and by industry. This approach cannot be successful unless it gains the support and participation of the industrial circles. In the implementation of the Community strategy, the small and medium enterprises must have special attention paid to their particular needs and constraints.

One point should be made before turning to the major objectives in this goal : because of the variety of economic and social goods produced by industry, these objectives are closely linked to other objectives in the framework programme. For example, improved use of raw materials and energy resources leads to the design of new and more competitive materials, products or processes and has a substantial impact on the development of the conventional industries (in actual fact about one-third of the activities benefiting these industries can stem from the spin-off from projects mainly directed towards other objectives). In the same way, the new technologies, through their applications, will make a vital contribution to the development of agricultural competitiveness, health, safety, the rational use of energy, etc.

THE MAJOR SCIENTIFIC AND TECHNICAL OBJECTIVES

In its role as a catalyst, Community R,D&D must stimulate cooperation both between different sectors of industry and between industry, research centres and universities. Improvement of European-wide cooperation is an ever-present consideration that is reflected in the three major objectives identified for the promotion of industrial competitiveness.

2.1. Removing and reducing impediments.

2.2. Improving and developing new technologies and new products for conventional industries.

2.3. Promoting and developing new technologies :

2.3.1. Information technology
2.3.2. Biotechnology.

2.1. REMOVING AND REDUCING IMPEDIMENTS

The comparability and quality of measurements are of great importance in the marketing of industrial goods and products : complaints about product quality stemming from incorrect or inaccurate measurements can be costly. When they involve the specification of quality criteria, the Community's standardizing activities also call for the development of reference materials and measuring methods recognized by all, as otherwise the desired harmonization effect cannot be obtained. Research and development in this field can certainly be regarded as a task for the Community. The scientific and technical aims will be to improve measurement methods and to prepare and certify reference materials in the nuclear field (energy and medical applications) and in fields where there are growing needs, such as metrology (dimensional, mechanical, electrical, optical and temperature), chemical analysis (especially metals, foods and industrial pollutants), and the physical and technological properties of materials.

With technical progress leading to greater complexity in products and hence in the inspection and measurement methods required, this activity is gaining in importance and is one of the ever-present aims of Community R&D.

In addition to this activity, other objectives such as the promotion and development of information technology call for standardization activities that are also designed to remove barriers.

2.2. IMPROVING AND DEVELOPING NEW TECHNIQUES AND NEW PRODUCTS FOR THE CONVENTIONAL INDUSTRIES

This objective is of vital importance because it is relevant to the greater part of the industrial fabric of our society. So far Community work in this field has been relatively limited and specific but it will be increased substantially during the period covered by the framework programme.

1. Following the approach outlined in the introduction, observation and forward studies will be carried out in consultation with the sectors concerned.

   Firstly, it is necessary to analyse, for a given sector or product, its properties, its functions, its market and the production process so as to examine how far the available technologies could improve quality, or modify the product and increase productivity. Secondly, a functional analysis must be carried out to identify the important traditional and new technologies and decide where they can best be used. It is also necessary to observe experiments on infratechnology renewal being conducted in Europe and elsewhere, especially the United States and Japan.
   The results of these studies will help in the evaluation of priorities for projects with the following objectives.

2. R&D on multisectoral technologies.
   The aim is to identify and improve key technologies common to many industrial sectors. This calls for cooperation between industry, research centres and universities.

   In the light of the studies already conducted and the requirements expressed by European industrialists, it will be necessary to make available sufficient resources to obtain a real break through by 1988 in the following directions :

   - the development of new materials (composites, superalloys, polymers, ceramics, etc.) with a higher performance or able to replace strategic materials that have to be imported,

- the improvement of reliability and wear resistance,

- the development of new techniques for shaping and working materials, in particular the use of lasers,

- the improvement of surface and membrane properties,

- the development and improvement of welding and other joning techniques,

- the development of new techniques and instruments, especially for quality control of products and for pollution measurements (see the objective "Environmental protection"),

- the development of catalytic processes.

Many sectors including the motor, machine tool, non-ferrous, transport and chemical industries will benefit from the results obtained.

3. R&D for technological renewal in specific sectors

The infratechnology of a sector can be renewed by the combined use of convergent technologies such as computer-aided manufacturing, new materials and new joining techniques. These technologies have often been developed in a different sector and have to be adapted to specific requirements and made compatible.

Priority will be given to the sectors currently most vulnerable, such as the textile, clothing and steel industries, and to sectors of economic or strategic importance likely to benefit most from infratechnology renewal, such as transport, machine tools, building and agrifoodstuffs.

4. Pilot or demonstration operations

To speed up the renewal of infratechnology in some sectors, it will be necessary not only to keep manufacturers informed of the new possibilities opened up by earlier research but also to speed up their practical application in the sectors concerned by means of pilot laboratory operations or even experimental demonstration operations within companies themselves. These projects will necessarily be limited in number and the sectors, firms, regions and countries concerned will be selected, in close cooperation with industry, mainly with a view to maximizing the desired snowball effect. The steel and clothing industries appear to merit priority here.

2.3. PROMOTING AND DEVELOPING NEW TECHNOLOGIES

2.3.1. INFORMATION TECHNOLOGY

Information technology (IT) is of strategic importance not only because of its far-reaching impact on many economic and social activities but also because of the size of the industrial sector it represents. If current growth rates continue, this sector will by 1990 be the largest in manufacturing industry, with a world turnover of around $ 600 thousand million. In this sector, where competitiveness depends on technological progress, the European industry is all too often dependent on imported solutions and lags behind in introducing the most recent technologies. The competitiveness of the European IT industry is at stake and a large R,D&D effort is of the utmost importance if Europe is to be brought to the technological level of its American and Japanese competitors. Aware of what is at issue, the Member States have launched or are preparing major R,D&D programmes at national level. The Community should not only help to concert national policies but should also, through powerfully catalytic activities, encourage the intra-Community collaboration necessary for reaching the scale of activity sufficient to ensure effectiveness and for the preparation of common norms and standards.

The objectives of the Community effort will be as follows :

1. R&D to master basic technologies

From the studies conducted and national experts consulted it is clear that the Community effort should be concentrated on the following five fields simultaneously. It is not possible to narrow down the choice today because progress in one field depends on progress made in the others.

Microelectronics

The cost and performance of all modern electronic systems depend on the progress made in microelectronics and in particular VLSI circuits. Europe, which absorbs 20% of the integrated circuit market but produces only 6%, cannot continue to be dependent on the United States and Japan in this key field. A substantial effort is necessary to develop in Europe a design, manufacturing and test capacity for VLSI circuits. To be competitive, the work must focus on submicron geometries.

Software engineering

Progress in software is as vital as progress in microelectronics in making European products competitive. Software development is costly and calls for European-wide cooperation so as to make best use of the

human resources available in Europe. Substantial progress must be made in software engineering, especially in improving generating techniques for "reusable" modular software needed to control the new generation of advanced information processing systems.

Advanced information processing

The new generation of advanced systems will enable man to communicate directly with the machine, which will operate in a way more similar to human reasoning, employing processes of association and deduction rather than calculation and data storage. The research must concern information science (representation of knowledge, inferential and deductive techniques), storage and use of knowledge, signal processing, outside interfaces and new computer architectures. This research will in particular lead to the design and operation of expert systems.

Office automation

Office automation will probably become the largest market for IT. In the United States, IBM and Xerox have so far spent more in this field than the whole of the European industry. The work should be concentrated on the many aspects of intelligent interactions between man and machine (integrated image-text-speech communication, document creation and distribution, etc.). Of the office automation functions, machine translation is of particular importance at Community level.

Integrated flexible manufacturing

The whole of manufacturing industry, whether small firms or big, will benefit greatly from the development of integrated systems combining computer-aided design, manufacturing, assembly, testing and repair. Together with office automation, this is one of the information technology applications that will have the largest market.

Research should relate in particular to the architecture of integrated systems, robotics and sensors and will need further developments in microelectronics and software.

2. Setting up of an inter-laboratory communication system

An information exchange system linking research centres, universities and industrial laboratories throughout the Community is an essential infrastructure for the implementation of cooperative Community R&D projects.

The system should supply a variety of services (exchange of information, exchange of codes and data banks and mutual access to computing facilities by the partners in the project) and it should be implemented mainly by using the communications facilities supplied by the postal and telecommunications authorities at national and international level and data processing facilities supplied by manufacturers. The Community effort should concentrate in particular on the standardization of high-level protocols.

Research will have to be carried out to ascertain the characteristics and procedures for rapid implementation of the system, which will be continually modified in the light of experience and could later be extended to the whole of the European research community.

3. Applications development and user training[1]

Exploiting technological capital so as to bring to the marketplace new products that are competitive and attractive to the user is obviously a weak link in the innovation process in information technology in Europe. An inadequate mastery of the basic technologies is not the only reason for this. Another is the tendency of European industrialists and users to prefer imported solutions, which are regarded as less risky.

A greater effort to develop IT applications and exchanges of experience would help to develop the European market and also to improve the competitiveness of the industries that would use the new technology. An effort on a Community scale is required because scattered national activities may do no more than open up a national market and because the field of applications is so vast that there is a risk of the new techniques not being introduced into some fields until it is too late.

The emphasis should be on sectors likely to benefit most from IT such as conventional industries, agriculture, medecine, transport, the nuclear industry, etc.

Implementation of these activities in the form of cooperative projects bringing together users, industry and research centres will help to vitalize the industry/user interface and will make a vital contribution to user training.

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[1] This objective should be examined in conjunction with the chapter on the technological renewal of specific sectors under the objective "Improving and developing new techniques and new products for the conventional industries".

2.3.? BIOTECHNOLOGY

The pragmatism which has so far held sway in the application of the life sciences will in the years ahead be transformed by the systematic and increased exploitation of the chemistry of self-organizing systems. Because of its potential applications in a wide range of absolutely vital sectors, biotechnology is a tool which may in the long term fundamentally modify current technologies and improve European competitiveness.

The aim of the proposed strategy is therefore to promote and improve the efficacy of public and private measures in this field and to create a favourable environment in which European biotechnology can flourish.

Biotechnology will create numerous products and services and will transform activities in several major conventional sectors such as pharmaceuticals, fine chemicals, agri-foodstuffs, the environment and in specialized sectors, some of which will become of great importance, such as energy from biomass, oil recovery, microbial metal leaching, etc.

Because of the wide variety of potential applications and the diversity of the solutions that biotechnology has to offer, work and exchanges must go beyond the national framework in order to achieve optimum efficiency. Also the "contextual" aspects (especially in the way of standards and regulations) must be developed in parallel with the research and its applications if the latter are actually to be undertaken, as was made clear by the difficulties encountered in the production of bioproteins. These contextual aspects obviously have a Community dimension. Consequently the objectives are as follows :

- mission-oriented research in key sectors (50% of the total effort),
- development of the applications of biotechnology (30%),
- support for European research in biotechnology by means of contextual measures to facilitate it (20%).

1. Mission-oriented research in key sectors of biotechnology

Here the main object is to stimulate and promote Community research projects with the long-term objective of removing obstacles to the use of modern biochemical and genetic methods in industry and agriculture.

These projects should include :

- fundamental studies on the genetics, physiology and biochemistry of microorganisms that can be used to synthesize from simple and abundant materials (carbon dioxide, hydrogen and methanol) a wide range of complex compounds now obtained from imported liquid hydrocarbons,

- improvement of methods for expression and transfer of new genetic information in organisms useful to man,

- harnessing of enzymes, microorganisms and cell lines for the production of high-value substances and the control of important processes,

- microbial physiology studies for improved understanding of factors affecting product yield, strain stability and rate of biomass production,

- photobiological research for the development of new bioconversion processes,

- dilute effluent processing techniques,

- computer systems for theoretical representation and drawing of the transformation of biologically active molecules,

- cryopreservation techniques for plant cells and tissues,

- improved basic knowledge of cellular and molecular pathology and development of new in-vitro pharmacological tests and new medicinal products, especially for preventive treatment, which can only be developed if public funds are made available (see the objective "Improving safety and protecting health"),

- research on the general topic of biological safety.

2. Development of applications[1]

In these development projects priority should be given to objectives identified in the framework programme; in the long term they will be the natural extension of the research projects described earlier.

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[1] This objective should be regarded in conjunction with the chapter on the technological renewal of specific sectors under the objective "Improving and developing new techniques and new products for the conventional industries".

In the immediate future the main emphasis will be on pilot or demonstration projects in the following fields :

- solar energy and the use of biomass,
- optimum land use and integrated management,
- enhancing the profitability of current agricultural products,
- waste processing,
- transfer to tropical agriculture of modern biotechnological methods and materials,
- use of modern biotechnological methods and materials in the study of nutrition problems.

3. Contextual measures

The following contextual measures have been identified :

a. encouraging Member States to develop centres of excellence (with a specific world-class capability) in selected fields; developing a European network based on these centres so that the Community as a whole has a world-class capability in all fields that is accessible to each Member State;

b. promoting the setting-up of multi-disciplinary project teams in universities and the exchange of scientists between industry and the universities and between the different Community countries, so as to develop the essential human resources;

c. developing the quality of supporting services and facilities so as to improve the environment for biotechnology (e.g. logistic support by developing European culture collections and associated data banks);

d. improving the European position in respect of intellectual property so as to protect it and facilitate its use.

Measures a. and b. above will partly be dealt with through the outline plan for stimulation (see goal 7).

GOAL 2 : PROMOTING INDUSTRIAL COMPETITIVENESS

Approximative breakdown between the specific objectives.

2.1. Removing and reducing impediments

Specific objectives	%
- Nuclear reference materials and techniques (energy and medical applications)	45
- Dimensional, mechanical, electrical, optical and temperature metrology	25
- Chemical analyses (metals, food and pollutants)	15
- Physical and technological properties of materials	15

2.2. Improving and developing new techniques and products for the conventional industries

Specific objectives	%
- Forward studies and observation	< 3
- R&D on multisectoral technologies (lasers, new materials, etc.)	40
- Sectoral R&D (steel, textiles, clothing, transport, etc.)	40
- Pilot or demonstration operations to speed up infratechnology modernization in certain industries (steel, textiles, etc.)	20

2.3. Promoting and developing new technologies

2.3.1. Information technology

Specific objectives	%
- R&D to master basic technologies : microelectronics, software engineering, advanced information processing, office automation and integrated flexible manufacturing	70
- Setting up of an inter-laboratory communication system needed for intra-Community cooperation in R&D	5
- Development of applications (conventional industries, nuclear, agriculture, medecine, etc.)	25

2.3.2. Biotechnology

Specific objectives	%
- Support for basic research in key sectors	50
- Strengthening of the European position by applications of biotechnology	30
- Contextual measures	20

If the Community action is to be significant and make an effective contribution to improving Europe's industrial competitiveness in comparison to its main rivals, it is essential to allocate funds totalling **more** than 1 000 million ECU (in constant 1982 values) for the period 1984-87, broken down as follows amongst the major objectives :

- Removing and reducing impediments	30	million ECU
- Conventional industries	350	million ECU
- New technologies	680	million ECU

Information technology 600 million ECU

Biotechnology 80 million ECU

This breakdown between the identified objectives will be reviewed as the implementation of the relevant actions will proceed.

Later addendum on:

Goal n°2. "Promoting industrial competitiveness" - 1.060 MioECUs

The Framework Programme illustrates the Commission's desire considerably to strengthen R, D&D oriented towards promoting industrial competitiveness. This desire was favourably received by the Council, but the discussion indicated that it would be useful to clarify the Commission's intentions. With this goal, and over and above the elimination and reduction of impediments, the Commission has two aims in mind :

- to promote, on the one hand, research into new technology and thus encourage the growth of the corresponding new industrial sectors; the Commission will put forward proposals to this effect and will examine the scientific and technical problems related to the field of telecommunications;

- on the other hand, to promote the development of basic technology common to several sectors (materials technology, lasers, etc..) and encourage its diffusion horizontally among all the "conventional" sectors of application for this technology and for new technology, particularly via pilot or demonstration projects dealing with infra technological renewal. In fact it is the diffusion of applications which is one of the keys to the modernisation of the fabric of European industry which is so vital in the face of the challenge being mounted by its external competitors. This is the aim of the objective "Improving and developing new techniques and new products for conventional industries" the over-abbreviated title of which, "Conventional industries", used in the summary tables might well have caused confusion. The proposals which the Commission will shortly put forward will illustrate this approach.

(Addendum continued)

It is not therefore a case of subsidising conventional industry, or aiding crisis-hit sectors, but actually encouraging the competitiveness of conventional industries by developing and applying new techniques especially in sectors where the size of the enterprises concerned (SMEs) makes it impossible for them to do the necessary research and development themselves.

It is clear that promoting industrial competitiveness cannot simply be done by research, development and demonstration activities in themselves but that it is necessary to take a certain number of accompanying measures going beyond the scientific and technical context in the strict sense of the term, such as measures to encourage investment, develop a transnational infrastructure in the field of innovation, facilitate industrial reconversion, etc..

3. IMPROVING THE MANAGEMENT OF RAW MATERIALS

3.1. OPTIMUM USE OF RAW MATERIALS

INTRODUCTION

Over and above fossil fuels, for which its degree of dependence is well known, the Community is heavily dependent on imports to cover its requirements for most renewable and non-renewable raw materials. Its dependence on outside sources is put at 75% for all the products it needs most. It is 100% or close to it for materials such as phosphates, chromium, cobalt, manganese, molybdenum, platinum, titanium, vanadium, niobium and tantalum. This situation is further aggravated by the uneven distribution of raw material resources throughout the world. More than three-quarters of the proven or estimated reserves of numerous raw materials are concentrated in a small number of countries, all outside the Community.

Aware of the implications of this situation, the European countries have taken steps to secure regular supplies of these essential materials. The range of measures includes the diversification of sources of supply, stockpiling, increasing self-sufficiency, more frequent use of secondary (recycled) raw materials, development of own resources of renewable materials (such as wood) and the replacement of scarce materials by others that can be obtained more easily.

Community research will help the Community to become less dependent on outside sources by building up its own production potential and making optimum use of the raw materials available.

SPECIFIC OBJECTIVES

1. Minerals

Exploration of deposits

The emphasis will be on the prospecting of deposits at great depths and the development of offshore methods. The fields to be given Community support include :

- exploration for deposits at great depths; improvements in remote sensing and studies on the genesis, structure and composition of the first 2-3 km of the earth's crust using a multidisciplinary approach;
- the improvement of prediction models;
- data interpretation techniques;
- coordination and improvement of information and data exchange systems;
- research on the marine environment.

Ore extraction and treatment and mining technology

Community activities should be directed towards the development of advanced technologies for :

- exploiting lean and complex ores;
- making marginal deposits workable by improving mining safety, ore extraction and haulage methods in the mines and techniques for working deposits with a high content and low tonnage;
- improving fines recovery;
- saving energy;
- improving the application of geostatistics and the modelling of mineworking;
- improving the design and performance of industrial ore flotation and treatment plants.

2. Wood

The Community has to import in order to cover more than half of its requirements for wood and products made from wood. In order of importance, this foreign trade deficit comes just after oil. Consumption is now

increasing faster than domestic production and the growing deficit calls for forceful actions by the Community, in particular through its R,D&D programmes.

Research on wood will therefore have two objectives : to reduce dependence on outside sources and improve the economic viability of the wood industries. Obviously these objectives are closely linked to two other sections of the framework programme, industry and agriculture, or more specifically forestry.

For timber production, the emphasis in the Community should be on increasing the quantity and improving the quality of wood for industrial applications. There are also other more specific objectives :

- Technological problems associated with the processing of wood and its use in the construction and furniture industries.

- Processing of wood and similar organic materials into fibre products. Priority should be given to new methods of making pulp from wood, techniques for producing better pulp from straw and other ligneous organic fibres and the adaptation of paper and board manufacturing processes to the characteristics of the new pulp produced;

- Chemical and biological processing of wood and the by-products of the timber industry (biotechnology applications are found here), in particular the improvement of methods of separating the constituents of wood and its by-products and of processes for the use of lignin, hemi-cellulose and cellulose.

3. Recycling

Community R,D&D projects in this field are justified not only because they will help to improve the Community's raw material situation but also because of their useful effects on the environment and the energy balance (for example conversion of waste into fuel). Research on recycling often has very close links with other objectives under the headings of agriculture, biotechnology, environmental protection, etc.

The specific objectives of the Community activities concerning recycling will be :

- improvement of waste sorting and processing techniques (mechanical and thermal) and the upgrading of products;

- processing of agricultural, forestry and organic waste (see the objectives "Agriculture" and "Biotechnology");

- advanced techniques for the recovery of strategic metals;

- the refining of secondary metals and other advanced techniques.

4. Substitution and materials technology

To reduce the risks of shortages and cut the deficit on its trade balance, the Community must promote R,D&D projects yielding a better knowledge of materials so that optimum use can be made of the possibilities of replacing strategic substances by more common elements, for example the substitution of chromium, silver, tin, tungsten and cobalt which are essential materials in the electrical, electronic and machine-tool industries, for the treatment of surfaces and for facings.

Apart from improving the Community's economic independence, research in this field will make a contribution to the objectives concerning the environment, energp and above all industrial competitiveness. That is why substitution and materials technology are included under the objective "Improving and developing new techniques and new products for the conventional industries".

COAL 3 : IMPROVING THE MANAGEMENT OF RAW MATERIALS

Approximate breakdown between the specific objectives.

3.1. Optimum use of raw materials

Specific objectives		%
- Minerals		65
. exploration	25	
. extraction, treatment, mining technology	40	
- Wood		25
- Recycling		10

For reasons of effectiveness, the funds to be allocated to this objective at Community level during the period 1984-87 should be at least 80 million ECU (in constant 1982 values).

Later addendum on:

Goal n°3. "Improving the management of raw materials" - 80 MioECUs

The level of resources available for this goal was considered too restricted to allow, notably, for an activity to develop "off-shore" methodology, which calls for considerable amounts of money. Since the Commission's intention is first of all to set about preliminary studies on the subject, it keeps open the possibility of expanding the scope of this goal at the first revision of the Framework Programme, in the light of results from these preliminary studies.

The presence of research relating to wood in this objective was queried. In fact one could also consider wood to be an agricultural product or regard research into its utilisation as being more appropriately placed under the heading "Improving industrial competitiveness". However the important thing is that the heading "wood" be included as a specific objective of the Framework Programme. The basic problem caused by the Community's import of wood and wood products, to the extent of one half of its total needs, has militated in favour of retaining this specific objective in this goal, but cross referencing it with the two other goals concerned. At the same time the recommendation was made that the problem of water, considered as a raw material, should be examined, together with the question of its availability. The objective "Protecting the environment" covers "the exhaustion and pollution of water tables" and thus involves some study of this aspect.

4. IMPROVING THE MANAGEMENT OF ENERGY RESOURCES AND REDUCING ENERGY DEPENDENCE

The need for the Community to face up to the energy challenge has frequently been reaffirmed by the European Council over the last few years.

The Community's energy strategy[1] underlines the logic of a wide-ranging community activity in the energy field, as well as the need for an increased effort to speed up the reduction in dependence on oil (energy savings, development of substitute energy sources, and diversification of supply and demand) and facilitate the adjustment of Community industry to the energy market.

Since 1974 this Community goal has been given the greatest weighting in scientific terms. By the year 2000, without retaining absolute priority, the pursuit of this goal should mean nonetheless a strengthening and above all an expansion of the corresponding R,D&D activities geared to the following major objectives : independence, long-term security of supply, competitiveness and safety.

At Community level, the develoment of nuclear fission energy must above all be viewed from the standpoint of nuclear safety and the special contribution that Community R,D&D can make to the acceptance of this form of energy, thanks among other things to wide-ranging work which, over and above the scientific results it contributes because of its exemplary value, the consensus it demonstrates and the independence appropriate to Community work, will be capable of exerting a positive influence on the nuclear controversy.

Research in the field of controlled thermonuclear fusion has, since its inception, been carried out in the context of a coordinated Community programme. The Council felt that, given on the one hand the contribution which fusion could make to energy supplies in the long term, and on the other hand the scale of the effort needed to reach the stage at which this technology could be applied, work which had been carried out until then in its various phases of development should be continued on a joint basis.

The development of renewable energy sources is not only intended to increase Europe's independence as far as energy is concerned but also to promote industrial competitiveness and agricultural productivity as well as strengthening aid to developing countries. A special effort needs to be made in this very wide field to promote, at Community level, those activities which are most likely to benefit from the Community dimension.

R,D&D in the sectors associated with the optimum use of fossil fuels, in particular the increased use of coal and other solid fuels, the production and use of synthetic fuels, energy conservation, the optimum use of heat (production, transport and storage) and new uses of electricity, coupled with systems analysis and energy planning studies, must enable energy to be used rationally, thus contributing to the aim of increasing independence, diversifying energy sources and optimizing costs.

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1 com(81)540 final : "The development of an energy strategy for the Community".

4.1. DEVELOPING NUCLEAR FISSION ENERGY (IN PARTICULAR ITS SAFETY ASPECTS)

INTRODUCTION

The development of nuclear fission energy is one of the main ways of reducing, through the diversification of energy sources, the Community's dependence on oil. The continuation of a resolute nuclear programme is therefore an essential aspect of European energy policy. The Community strategy[1] provides for the consolidation and intensification of research activities, in particular in the general fields of nuclear safety, health and environmental protection, and fissile materials safeguards. The European Parliament has adopted a resolution approving and confirming this strategy upon which the Council also took a favourable position[2]. It should also be recalled that the nuclear option embraces the development of the entire fuel cycle, including reprocessing and fast reactors.

It is with this in mind that the present guidelines for Community R&D have been drawn up.

ORIENTATIONS

Community R,D&D activities will therefore be mainly directed towards the safety aspects, i.e. the protection of workers and the general public against nuclear hazards. In this manner Community research can exert a positive influence on the nuclear controversy, by providing objective information that transcends the national dimension. By helping to harmonize national approaches to safety, Community action also assists in promoting industrial competitiveness by reducing the barriers to intra-European trade.

At international level, there is an increasingly marked tendency to cooperate in the general field of nuclear safety, a trend which is considered extremely favourable for the development of this energy source and will be taken into account by Community action.

The main areas taken into consideration are reactor safety, the management and storage of radioactive waste, radiation protection, fissile materials safeguards, the decommissioning of nuclear plants, and- in the remainder of the fuel cycle that has already reached the industrial stage- certain safety aspects which call for Community action.

SPECIFIC OBJECTIVES

1. Reactor safety

   The light water reactor concept has already reached industrial and commercial maturity : over two hundred reactors of this type are in service throughout the world. The dissemination of this technology and the impact it has had on society call for further research on safety.

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1 COM (82) 36 final : An Energy Strategy for the Community : the Nuclear Aspects.

2 Energy Council of 13 July 1982.

The main reasons reside in the need to assess more accurately the safety margins - and thus increase the availability - of reactors, to establish a joint approach to safety standards, and to facilitate the decision-making process. Furthermore, a Community research programme can contribute to better public acceptance of this energy source.

The actions, taken by the Community in this area should therefore pursue the following objectives :

- to exploit to the full the operating data from the 80 of so reactors currently in service in the Member States, which provide an irreplaceable data base for improving our knowledge of the reliability of the plant, systems and components, and of the effect of human factors on safety. Using these data, probabilistic methods - whose development should be continued - will enable risk assessment to be improved;

- to develop different accident prevention techniques and methodologies, focusing in particular on monitoring systems, instrumentation and inspection techniques;

- to improve our knowledge of the mechanisms governing accidents, by combining theoretical and experimental research, in order to improve the calculation codes used for safety analyses. The comparison of the different codes, the dissemination of information and the presentation of the codes validated in the light of this work to their potential users are all factors that should bring about a gradual harmonization of nuclear safety analyses at European level;

- to improve, by means of in-pile and out-of-pile experiments, the knowledge of accident sequences, with a view to establishing rules for the behaviour of operators in the event of an emergency.

These objectives should be pursued in parallel with an effort to stimulate the exchange of information within the Community, which will provide the indispensable technical basis for harmonizing safety guides and practices at European level.

The first commercial-size fast reactor for power generation is currently being built in Europe; the sodium-cooled fast breeder reactor design has therefore not yet been developed to the same degree as the light water concept. Safety research is still necessary in order to prepare more effectively for the widespread use of these reactors on an industrial scale. The main features of such research will be accident prevention, the study of fuel and core behaviour in abnormal operating conditions (covering the various accident phases up to and including the disassembly stage), the study of the behaviour of structures and components under loads corresponding to these hypothetical accidents, and the evaluation of post-accident conditions. These studies should lead to the establishment of a common basis for calculation codes that would be widely accepted and capable of harmonizing the approach to the safety of these reactors at European level and helping to remove the barriers to trade in fast reactor components.

In a more general context, i.e. without any reference to a specific reactor concept, special attention will be devoted to man-machine interaction and ergonomics, as well as to the introduction of new technologies (in particular information technology applications) in this industrial sector (see also the objectives "Improving safety and protecting health" and "Promoting industrial competitiveness").

All these objectives can only be attained through a balanced combination of theoretical and experimental research. The latter aspect requires the use of large facilities and multidisciplinary teams of a high standard, and should be carried out with the widest possible international co-operation. Such cooperation should be reflected at Community level in a pooling of efforts around major experiments, conducted either in Community research centres or in national centres with Community participation. This would also facilitate international collaboration, the results of which would be available to all the Member States.

2. The Community has several decades of experience in the management of radioactive wastes; however, the ultimate stage in the cycle - final disposal - is carried out only in the case of low-activity, relatively short-lived wastes. The aim of Community R, D&D is therefore to demonstrate a complete management scheme that ensures at every stage the protection of man and his environment.

The twelve-year (1980-92) Community plan of action on radioactive waste[1], which the Council approved in 1980, provides for indispensable Community consultation, as well as the guidance and continuity of the activities conducted in this field. The objectives pursued by Community action will be :

- as far as the waste treatment, conditioning and handling phase are concerned :
  - . the optimization of the existing methods for low- and medium-activity wastes and the provision of more economical, safer and more efficient methods;
  - . the development of processes for immobilizing certain high-activity, long-lived wastes in suitable solid forms with a view to final storage;
  - . the development of similar processes for gaseous wastes, since it may no longer be possible in future to discharge them as effluents.

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[1] O.J. C 51, 29.2.1980, p. 1.

In addition to this work, criteria should be drawn up for the quality of wastes with a view to their storage;

- as regards the final disposal of high-activity wastes:

  . the demonstration, by means of the design, engineering and operation of experimental underground chambers and prototype facilities, of the feasibility of final disposal in deep continental geological formations (salt, granite, clay, etc.);

  . the evaluation, by means of laboratory experiments and in-situ tests, of the feasibility of the final storage method consisting of burial under the ocean sediments;

  . the evaluation of the safety of the different final disposal options by developing risk analysis methodologies and by modelling phenomena on the basis of experimental results. This approach compensates for the fact that very long-term safety cannot be demonstrated directly, and it will be refined in the light of all the experimental achievements.

  If these objectives are to be attained, the Community R,D&D effort -which has for several years pooled a significant proportion of the Member States' activities, concerning final disposal in particular must be continued without interruption.

  European cooperation and Community coordination should be strengthened, as well as international cooperation in the wider sense, since it is only through joint efforts that final disposal will be demonstrated convincingly to public opinion.

3. The problems raised by nuclear plants withdrawn from service are of general interest and call for Community action on the decommissioning of nuclear plants. The aims should be to improve and develop new specialized decommissioning techniques, and to test them in real-service conditions during major decommissioning operations undertaken in the Member States. The problems associated with the possible re-use of the materials recovered will also be tackled.

4. The other stages in the fuel cycle, namely fabrication, enrichment and reprocessing, which have reached industrial and commercial maturity, should not in themselves be the subject of Community research, except possibly on certain specific aspects of general interest that always have a bearing on safety (aerosols, for example).

5. The methods for protecting workers and the general public against the radiation emitted throughout the fuel cycle and the monitoring of its consequences constitute a priority Community objective. The biological effects of radiation - especially the effect of low doses - should be studied in order to evaluate risks realistically (see the objective "Improving safety and protecting health").

6. The importance and economic impact of safeguards and the need to establish a European strategy on this issue for the nineties require a major action to be taken by the Community and national efforts to be concerted. In order to facilitate the implementation of multinational (Euratom) and international (IAEA) safeguards systems, work conducted by the Community will be geared to developing instrumentation for the identification, measurement, confinement and surveillance of nuclear materials, and evaluating the in-plant performance of such instrumentation; developing a functional, integrated data assessment and transmission system; and studying or developing methodologies for the parametric analysis and optimization of safeguards techniques in different types of plant or in the fuel cycle. All these activities will give due regard to industrial needs in Europe and the increase in the amount of nuclear materials in circulation.

7. In order to achieve the aims mentioned in this plan, it is necessary to have a number of accurate, universally-accepted nuclear data; the development of the nuclear industry and the application of nuclear techniques in other fields make it necessary to have nuclear reference materials (see also the objective "Removing or reducing impediments").

8. Lastly, fundamental research should not be absent from the Community's concerns in the nuclear field, and an activity compatible with the above-mentioned objectives will be maintained in research on actinides, in which the Community has for many years been in the forefront.

   Special mention should be made of the high flux reactor (HFR) at the Joint Research Centre's Petten Establishment, which is used for irradiating fuels and structural materials as part of the reactor safety activities, investigating the strength of materials for the fusion programme and producing radio-isotopes.

4.2. CONTROLLED THERMONUCLEAR FUSION

INTRODUCTION

Since thermonuclear fusion is one of the possible solutions to the long-term energy problem, huge research programmes were embarked upon as soon as the Second World War was over in order to bring thermonuclear fusion out of the realm of theory and into that of reality.

OBJECTIVES FOR COMMUNITY R,D&D

Three major objectives will have to be fulfilled in turn :

- scientific feasibility, which it is hoped to demonstrate in the eighties by the large tokamak experiments, the construction work for which is almost completed (JET in the European Community, TFTR in the US and JT 60 in Japan);

- technical feasibility, in particular as regards the large-scale production and handling of tritium, the strength of materials, remote handling, superconducting coils and conversion of the fusion energy, which is to be demonstrated by the extremely large and costly machines currently envisaged : NET in Europe, ETR in the United States, FER in Japan, INTOR under a joint project grouping together the European Community, the United States, the Soviet Union and Japan, and other machines that could be built in the context of international cooperation;

- lastly, commercial feasibility, which could be demonstrated at the beginning of the next century using an experimental power reactor referred to as DEMO.

This will be a long and costly endeavour, and it seems unlikely that energy will be produced industrially from nuclear fusion on a large scale before some fifty years hence; by then, world R,D&D expenditure will probably have exceeded 100 000 million ECU.

Europe leads the field in research on fusion reactors based on the magnetic confinement principle, and the European programme - which groups together under Community coordination all the Member States' activities in this field - should be continued without respite. It is necessary to pursue efforts aimed at demonstrating the scientific feasibility of fusion, while at the same time undertaking new efforts to demonstrate its technical feasibility. European cooperation and coordination by the Commission should be strengthened, since it is only through joint action that the Member States will be able to take up the challenge of fusion. The oportunities for cooperating with the other world programmes should at the same time be fully exploited.

The strategy underlying the European programme consists of the following :

- carrying out a substantial programme on the tokamak concept with a view

to building a demonstration reactor, completing the first stage of this programme (the JET project and its extensions) and carrying out programmes to back up work on the tokamak configuration;

- continuing to develop the technology necessary for the second stage of the tokamak programme (NET) in accordance with the guidelines emerging from the conceptual studies;

- studying alternative confinement systems that are likely to lead to a fusion reactor, preferably in collaboration with other world fusion programmes, in particular in the United States;

- examining towards the end of the eighties the results of JET and of similar experiments that are to be carried out elsewhere and deciding whether to go ahead with the second stage of the tokamak programme.

Simultaneously with these activities, studies are being carried out on fusion reactor systems in order to keep constantly abreast of the state of the art and to hold the programme on course towards its ultimate objective - the demonstration reactor (DEMO).

The Council Decision of 25 May 1982 adopted the 1982-86 programme, which has a budget of 620 million ECU, consisting of 319 million ECU for the JET project and 301 million ECU for the rest of the programme. Some 1000 researchers are involved in the Community programme.

This recent Decision has therefore laid down the guidelines for R,D&D in this area until 1986, and the long-term goal on fusion is thus being deliberately and resolutely pursued. The corresponding activities designed to demonstrate the scientific feasibility of fusion and tackling the problem of demonstrating its technical feasibility should receive throughout the duration of this framework programme financial resources that will remain fairly constant in the case of physics research, but will increase considerably for technological research.

4.3. DEVELOPING RENEWABLE ENERGY SOURCES

INTRODUCTION

Under the Community's energy supply stragegy[1], the development of renewable energy sources is one of the priority objectives; this will contribute to a more rapid reduction in oil dependence and help in adapting Community industry to the energy market.

As regards the renewable energies, which are attractive because of their decentralized nature and the possibilities they offer for gaining some independence from imports, a large number of activities have been embarked upon that pave the way for applications in the short, medium and long term.

A considerable effort nevertheless remains to be made in order to demonstrate their technical and economic feasibility and to increase the chances of a market developing for the devices that use these energy sources.

The development of such a market would be beneficial both in reducing the Community's energy dependence and in terms of employment.

The contribution of the renewable energies should almost double during this decade and reach the figure of approximately 26 million TOE/y by 1990. If due regard is given to the investment needed to develop this energy production capacity, the beneficial effects on employment of the implementation of these new technologies are evident.

Also, the activities to be undertaken in this area will not only work towards the main goal of "Improving the management of energy resources", but will at the same time contribute to other objectives such as improving the environment, increasing industrial and agricultural competitiveness and assisting the developing countries.

The following paragraphs will discuss the main renewable energy sources : direct solar energy, biomass, wind power, geothermal energy and hydro-electric power, each providing the target for a specific research objective. Priority will be given to direct solar energy, biomass and geothermal energy, followed by wind and hydroelectric power. Work carried out to pursue these specific objectives should also include the development at Community level of methods and installations for testing and assessing devices and concepts, as well as actions to solve the problems limiting the application of new concepts, such as those involving materials.

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[1] COM(81) 540 final, 2.10.1981, "The Development of an Energy Strategy for the Community".

SPECIFIC OBJECTIVES

1. Direct solar energy

The considerable solar energy potential that is available in the Community justifies a substantial R,D&D activity focusing on heat and electricity production.

As regards thermal applications, the Community programmes should continue to develop - especially as demonstration projects - technologies for space heating, hot water production and air conditioning of buildings, applying inter alia the techniques of passive architecture. The integration of various technologies (heat pumps, storage, etc.) into "hybrid" systems in which solar energy plays a part will be assessed.

These programmes should also study the development of new technologies that can be applied to industry (heat for various industrial processes), agriculture ("solar" greenhouses and drying, water pumping and irrigation) and water desalination. In some of the areas mentioned, in which considerable progress has already been made, greater emphasis should be laid on demonstration than on research.

In the electricity production sector, work on solar power stations should be brought to a successful conclusion, while stress should be laid on photovoltaic conversion, by continuing research on new solar cells and installing pilot facilities.

2. Biomass

The theoretical potential of biomass in Europe makes it one of the largest renewable energy sources. Wood together with agricultural wastes and certain "fuel" crops could make a significant contribution. The relative priorities to be attributed to the various possible uses of biomass and the types of land on which it could be harvested, and the research that should be devoted to the subject have been discussed under the objective "Improving agricultural competitiveness" of this document.

Be that as it may, R,D&D work in this sector should be conducted at Community level, in particular basic research on photobiology, fermentation and cellulose hydrolysis using enzymes.

Fuel crops (including algae) will be the subject mainly of research projects, as well biomass combustion, pyrolysis and hydroliquefaction and the development and improvement of thermochemical and fermentation processes for converting biomass into liquid fuels (see also the objective "Biotechnology").

3. Wind power

New technologies could promote the large-scale use of wind power in certain regions of the Community. R,D&D will concentrate on generators of all sizes, on centralized and decentralized electricity generating with connection to the national grid in the majority of cases, and on the other applications of this energy source. In addition, the potential of Community wind power production will be assessed.

4. Geothermal energy

Thanks to new discoveries, this form of energy could provide a greater contribution to the European energy scene. Priority should be given in Community projects to hot dry rocks, in view of the large potential they represent for electricity production, and to the production and utilization of low-grade heat, in which reinjection problems still call for research work and space heating units using lukewarm water should be the subject of demonstration projects.

The study of high-temperature sources (mainly pressurized brine) suitable for producing electricity will require increased R&D efforts, for example the study of corrosion and reinjection problems.

In addition, the Community programme should continue its assessment of European geothermal potential.

5. Hydroelectric power

Hydroelectric technology, which is already well-developed, does not require further research. The Community will nevertheless support demonstration projects aimed at exploiting small-capacity hydroelectric power sources.

6. Other aspects of renewable energy sources

Apart from the technical and economic problems curbing the market penetration of the renewable energies, other factors of a legal, social or environmental nature can also act as a hindrance to such penetration. These factors should as far as possible be the subject of work conducted simultaneously with the R,D&D proper.

It will also be necessary to give due regard to local features when developing the various technologies. This is particularly obvious in the case of the technologies that are likely to contribute to the energy supplies of the developing countries (see the objective "S and T activities of benefit to developing countries").

4.4. RATIONAL USE OF ENERGY

INTRODUCTION

The aim of rational use of energy (RUE) is to optimize the energy system, which is subjected to a variety of policies and constraints. This is therefore a huge area that is closely connected with several other objectives, such as the improvement of industrial processes and environmental protection.

Our understanding of the way in which the energy system operates should be improved, while at the same time new techniques should be developed that will help towards optimizing it. With this in mind and despite the disparities between the Member States' energy resources, a number of Community objectives can be identified. The most important are the study of solid fuels (coal[1] in particular), energy savings, hydrocarbons, heat transport and storage, electricity production and systems analysis.

SPECIFIC OBJECTIVES

1. Systems analysis

The activities relating to systems analysis coordinated by the Commission have contributed to a better understanding of energy supply and demand systems and of their interactions with each other, with other sectors and with the economy in general. Models have been developed and are at present operational.

The main aims of Community activities are currently to improve and apply the models that have already been developed, if necessary to extend them, to update the data bases and to develop new models and models that can be applied to the developing countries.

2. Energy savings

Residential and commercial sector

The importance of the energy resource represented by savings in space heating is considerable : by the year 2000, such savings could amount to as much as 50% of a consumption that currently accounts for one-third of the overall energy demand.

Most of the R,D&D efforts have hitherto focused on new buildings. It is now necessary for greater attention to be devoted to the improvement of the existing building stock, where there is a considerable potential for savings.

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[1] The Role of Coal in the Community Energy Strategy, O.J. C 105, 26.4.1982.

The Community actions will deal with the coordination, standardization and dissemination of information using a data base on existing energy saving techniques, their efficiency and the standards governing them.

R,D&D activities proper will focus primarily on advanced techniques for the insulation, ventilation, heating and energy management of buildings. Systems and architectural studies and socio-economic research will also be conducted.

Demonstration projects will mainly involve public buildings, blocks of flats, and cooperative or local authority buildings and will provide the data enabling national and regional projects to be assessed, adopted and implemented.

Industrial sector

This sector accounts for approximately 35% of total energy demand, which makes clear immediately the considerable impact of the savings that can be made by various means, namely :

1. by reducing energy consumption in production processes and recovering the thermal energy released at various stages in these processes;

2. by implementing new, more energy-efficient processes; and

3. by using materials and products whose manufacture incorporates as little energy as possible.

In order to avoid having to devote too great an effort to specific sectors, Community research will focus primarily on point 1, while the demonstration will concentrate on points 1 and 2 and, as a matter of priority, on the problems of RUE in small and medium-sized firms, a more modest effort being made for the benefit of heavy industry.

Energy modelling of processes will be used in order to attain the most important objective, which is to arrive at greater efficiency in the production and use of heat and electricity in industry.

Another important aspect is that of the substitution of hydrocarbons, i.e. the use of non-renewable energy sources instead of liquid or gaseous hydrocarbons.

Agricultural sector

Demonstration projects are one of the best ways of revealing the energy savings that can be made in agriculture. A preferential area for such projects is the drying of crops.

Transport sector

The energy consumed in this sector is derived almost exclusively from petroleum products, which has already made it the subject of major programmes carried out by private and public bodies. The Community will devote special attention to energy savings in transport, both by improving existing technologies and by developing unconventional vehicles and new technologies. In particular, the development and use of materials, alloys and ceramics will make it possible to achieve greater energy efficiencies.

3. Solid fuels

The revival of interest in R,D&D on solid fuels is connected with the aim of increasing the share of coal in electricity production and of replacing oil by coal (or by synthetic fuels produced from coal) in a number of sectors.

Without neglecting the transport and processing of solid fuels, R,D&D will have to focus primarily on the following topics :

Production

As regards coal production, the objective remains increased productivity; Community R,D&D activities will consequently continue on the lines of the current ECSC programme, which is also concerned with safety and the improvement of working conditions (see the objective "Improving safety and protecting health").

Utilization

Community R,D&D will be aimed at improving combustion processes and the processes for converting solid fuels into gaseous or liquid products, in order more fully to satisfy the requirements of energy systems based on the use of liquid fuels.

The aim of the work on combustion will be to develop and demonstrate new technologies - such as fluidized-bed combustion and combustion of solid/fluid mixtures - and to improve burners and conventional combustion systems.

As far as gasification is concerned, in view of the scope of the work in progress in various places, the Community programmes will concentrate on demonstration and basic research on new processes. The Community will also continue to support underground gasification projects.

As regards liquefaction either after preliminary gasification or by direct hydroliquefaction, the Community will support R,D&D projects on the production of synthetic liquid fuels. This work could also have repercussions on biomass conversion technology.

Coal characterization, the techno-economic evaluation of the different synthetic fuels, their specific uses and standardization and problems concerning materials will also be studied.

Associated R,D&D activities

The work described above, which is of a technological nature, will be backed up by basic research in physics and chemistry aimed at gaining a better understanding of the various processes involved.

In addition, at each stage in the development, production and use of solid fuels, it will be extremely important to examine whether they are compatible with the need to protect the environment (see the objective "Protecting the environment").

4. Heat

Community research in this field will relate to the transport and storage of heat. As regard transport, the aim is to improve the energy management of district heating systems through the use of telemetering devices and modelling, to develop thermochemical systems for supplying process heat and to perfect large heat pumps.

Work on storage will relate to small- and large-scale storage over short and long periods using methods such as chemical storage. This work will be supplemented by economic assessments.

4. Electricity

The objectives of Community R,D&D will concern the development of new industrial processes for using the electricity generated by sources other than hydrocarbons, the development of electric-powered vehicles and new types of batteries and the improvement of the efficiency with which this form of energy is used.

GOAL 4 : IMPROVING THE MANAGEMENT OF ENERGY RESOURCES

Approximative breakdown between the specific objectives.

4.1. Nuclear fission energy

Specific objectives	%	%
- Reactor safety		60
. Light water reactors : use of operating data; accident prevention; improved knowledge of the mechanisms governing accidents; harmonization.	40	
. Fast reactors : accident prevention; study of the behaviour of fuel sub-assemblies, the core, structures and components in abnormal operating conditions; evaluation of post-accident conditions.	20	
- Radioactive waste : waste treatment, conditioning and handling; final disposal of high-activity wastes.		15
- Plant decommissioning : development and application of techniques in real-service conditions. Safety aspects of other steps of the fuel cycle. Protection of workers and the general public.		10
- Safeguards.		10
- Nuclear measurements and reference materials. Research on actinides.		5

4.2. Controlled thermonuclear fusion

Specific objectives		%
- Construction and operation of JET		50
- Tokamak of medium dimensions (including heating and diagnostics)		30
- NET and technology		15
- Alternative lines of development to tokamaks		5
- Lasers	<	3

4.3. Renewable energy sources

Specific objectives	
- Direct solar energy	30
- Biomass	25
- Wind power	15
- Geothermal energy	20
- Hydroelectric power	5
- Other	5

4.4. Rational use of energy

Specific objectives		
- Systems analysis	<	3
- Energy savings		40
- Solid fuels		45
- Heat		10
- Electricity		5

If results that are both significant and commensurate with requirements are to be obtained in this field, the financing of Community activities for the goal "Improving the management of energy resources and reducing energy dependence" should amount to at least 1 900 million ECU (in constant 1982 values) over the period 1984-87, broken down as follows :

- developing nuclear fission energy	540 million ECU
- controlled thermonuclear fusion	480 million ECU
- developing renewable energy sources	310 million ECU
- rational use of energy	520 million ECU

Later addendum on:

Goal n°4. "Improving the management of energy resources and reducing energy dependence" - 1.850 MioECUs, adjusted to 1.770 MioECUs.

As a response to certain queries made by national delegations the Commission felt it necessary to go rather deeper into its analysis of the amount of resources required for the objective "Developing Nuclear Fission Energy". This analysis made it possible to differentiate, among the objectives identified between research making a direct contribution to the development of this form of energy and research which contributes to the objectives "Improving Safety and Protecting Health" and "Protecting the Environment", which should therefore be allocated to the goal "Improving Living and Working Conditions". This examination led to the transfer of 80 MioECUs in favour of the latter goal.

With this exception the Commission is retaining the internal balance as initially proposed, that is :

- Developing nuclear fission energy	460 instead of 540
- Controlled thermonuclear fusion	480
- Developing renewable energy sources	310
- Rational use of energy	520
Option 4 : Improving the management of energy resources and reducing energy dependence	1.770 MioECUs instead of 1.850

(Addendum continued)

However it should be noted that in 1984 the Commission will have cause to formulate concrete proposals of major importance in the field of thermonuclear fusion and demonstration projects. These proposals will take account of results obtained from programmes now under way and should lead to a penetrating discussion of the criteria which should particularly be adopted in these fields so far as community activity is concerned. This could lead to a modification of the internal balance for this goal. The Commission thus considers, whilst maintaining its proposal as to the relative scale of resources devoted to this option in the Framework programme, that the proportions allocated to the four objectives making it up could be reviewed in the light of factors related to the implementation of the programmes.

5. REINFORCING DEVELOPMENT AID

5.1. UNDERTAKING SCIENTIFIC AND TECHNICAL ACTIVITIES FOR THE BENEFIT OF THE DEVELOPING COUNTRIES

INTRODUCTION

Up to now the contribution which the Community has made to the developing countries so far as scientific and technical research is concerned has been in four basic forms :

- financial contributions to international Institutes related to the CGIAR,

- finance for a "research" element in development operations,

- finance for certain investments with scientific objectives,

- contributions to the training of researchers and technicians.

This contribution has been by no means negligible, either in the amount of aid or in the results obtained, since in addition to other sources of aid, both bilateral and multilateral it has made possible the development or conservation of scientific activities of value to development.

But such actions have not been part of an overall policy framework. Their ad hoc nature may well partly militate against their effectiveness.

The Framework Programme will make it possible to give more coherence to this activity and make it more effective. It takes on particular importance because of the chance it will give to developing countries to choose the most appropriate avenues by which to encourage their own development. Community assistance in the scientific and technical area, as in other areas, should only support policies freely defined in the context of a dialogue between the Community and the countries concerned on the efficacy and adequacy of such policies. The framework programme will enable the Community to orientate its scientific and technical activities for the benefit of developing countries in a better way. The Community dimension holds out possibilities in this respect which ought to be followed up, and in this context, it would be useful to examine the whole range of Member States and Community programmes in such a way as to give the overall effort maximum coherence and effectiveness.

GENERAL OBJECTIVES

The orientation to be given to this aid should be founded upon the following considerations :

a) Scientific research plays an important part in the development process. The inadequate attempts in this direction made by the developing countries call for a realisation on the part of those with the political responsibility in the developed countries of the importance which research had for their own development. The situation also calls for outside help so that an autonomous research capacility can be built up within these countries, which would be able to carry out their own scientific research designed to control their own destiny.

b) This outside help should have two aspects :

- aid via international or Community organisations, which contribute already and which guarantee immediate efficacy and the necessary continuity. This procedure has given good results in the past. It should at the same time be better oriented towards the needs of the recipient c ountries and better mobilise, for the benefit of developing countries, the heritage of knowledge which is available in the countries of the Community as well as the basic research capacities of the Member States.

- aid for the development of national and regional research systems in the developing countries. This is a long job, made risky by the existence of the first form of aid. But it is the primary objective which will, in the end, make it possible to ensure the technological maturity of States and cooperation with the international scientific community.

When implementing activities, it would be expedient to make sure that the research is firmly placed in the local context particularly by :

- conserving what is already known by making an inventory of and making use of traditional technical knowledge and sustaining existing scientific communities ;

- scientific research at university level into traditional skills (medicine, construction materials, architectural styles) so that ways of using them in the development process may be specified.

- support for b asic local organisations for designing and implementing activities which generate innovation (exhibitions, competitions, the donation of prizes).

c) It is agriculture which must at first form the primary theme of the effort: this priority is compatible with the EEC's policy which puts agriculture at the centre of developing countries development efforts and which is about to increase the role of agriculture in community scientific research themes.

With this in mind an activity is currently under way to mobilise Europe's scientific potential - very much on the basic side - for the benefit of development. It should be supplemented by an effort aimed at developing indigenous research capacity in the partner states by encouraging research with a view to short or medium-term results, but not to the exclusion of all else.

CRITERIA FOR SELECTING ACTIVITIES AND DECIDING RESOURCES

a) Depending on a country's level of scientific development, aid must take appropriate forms. In the countries which are least developed, barely at subsistance level, aid via foreign research workers must predominate for the time being, whilst an effort to train local researchers and to make ready a reception infrastructure should be being made as a reserve for the future.

In States which have already reached a certain scientific capacity the dominant form of aid should be that directed to centres of excellence which, when boosted in this way could become centres for national and regional advancement in greatly varying forms ranging from inter-institutional cooperation programmes to the setting up of systems designed to facilitate the reintegration of national research workers who happen to be in European or other countries.

It is on the basis of such centres that a certain level of regional coordination could be undertaken with a view to making better use of available human and materials resources.

b) On the one hand, outside research must be mobilised more and more in respect of topi cs which require sophisticated human and material resources, leaving local research capacity to tackle, progressively, those topics which can more easily be coped with under local conditions.

On the other hand, aid to research projects should undergo a rigorous evaluation of their characteristics : the extent to which objectives are relevant, the methodology appropriate and the recipient teams well thought of. In short, it is vital that criteria relating to quality prevail over considerations of local opportunity.

c) Six sectoral orientations are suggested because of their compatibility with Community policy on development aid :

- agriculture, forestry, the campaign against the encroachment of desert areas, fish (including fish breeding), favouring those topics relating to self sufficiency in food, and rural development,

- the environment : hydrogeology and climatology,

- health notably problems of infant nutrition and that of the mother (related to agricultural production and food aid) and tropical diseases,

- resources of the soil, and belowground : geological prospecting,

- energy : renewable sources of energy appropriate to subsistance economies,

- population : demographic studies.

GOAL 5 : REINFORCING DEVELOPMENT AID : SCIENTIFIC AND TECHNICAL ACTIVITIES

An indicative split of the outlay as between the various specific objectives

5.1. Scientific and technical activities for developing countries

Specific Objectives

- Agriculture, breeding, forestry, desertification	50 %
- Fish and fish breeding	10 %
- Population and health	20 %
- Fossil resources	10 %
- Energy	5 %
- Environment	5 %

The overall Community action in this goal, taking place both within the Community and the developing countries, should receive resources appropriate to the importance of the objective. For the period 1984-1987 these are estimated to be at least 150 MioECUS (at 1982 prices).

Later addendum on:

Goal n°5. "Reinforcing development aid" - 150 MioECUs

Following the line of the "Memorandum on Community development policy" [1], and in response to the increasing volume of requests for developing countries for Community action in the field of science and technology for development, the Commission included the goal "Reinforcing development aid" in the Framework Programme from the outset. This goal was subsequently quantified in the document COM(82)865 final. Some delegations requested that the results of the programme "Science and technology for development" be awaited before coming to a decision on the proposed expenditure.

The Commission would like it to be noted that the point now is to demonstrate its political will and indicate the financial implications of its proposals. The operational procedures will be defined gradually and experience gained during the first specific programme in this field will be taken into account.

The Commission feels that the current programme "Science and Technology for Developing Countries" with its two parts "Agriculture" and "Tropical Medicine" is the start of a more wide ranging activity. It would emphasise that it is not feasible to wait for the completion of a subsequent evaluation before launching another activity in this field. This approach would be too rigid and would entail the danger of interrupting a long term activity and thus damaging the motivation of researchers and disappointing the expectations of developing countries, which are increasingly calling for community action in science and technology.

In the Commission's view it is not necessary to modify the expenditure proposed for this option.

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[1] COM(82)640

6. IMPROVING LIVING AND WORKING CONDITIONS

Within this exteremely wide field only two scientific and technical objectives have been selected at this time. They are set out in more details below. Further scientific and technical objectives may be anticipated in successive revisions of the Framework Programme.

6.1. IMPROVING SAFETY AND PROTECTING HEALTH

INTRODUCTION

Improving safety and protecting health are important measures to assure a high quality of life for the individual. Since health refers to the state of well-being of the individual and safety to his protection from environmental risks, both are interdependent and are considered jointly. Health is also one of the priority objectives in Community scientific and technical activities for the benefit of developing countries.

The objective of Community R, D&D efforts is to improve knowledge in the following areas :

1. Human adaptation
2. Reproduction, growth and ageing,
3. Personal environment,
4. Health technology,
5. Health care, and
6. Health promotion.

The criteria for selection of priorities include the relevance in terms of the dimension of the problem(s), the potential for application, the expected impact on the decrease of health care costs, and the significance of statistical data, the value of which increases with the size of the population. The criteria used must be viewed in a perspective of the global objectives as determined by WHO and other agencies. Throughout, the concept applied is one of health defined in terms of maximal performance recognizing internal, and more importantly, external constraints.

A major aim is to promote the transfer of basic knowledge gained by ongoing research into practice. Concerning overall orientation, there is a shift from corrective measures to primary prevention.

SPECIFIC OBJECTIVES

1. Human adaptation

Individual adaptability

Research should be directed towards identifying indicators of adaptability of the individual functioning in his family and social context at various ages.

Stimulants (coffee, alcohol, psychotropics, and illicit drugs) that affect individual behaviour should be investigated in terms of their effect on the adaptive process.

Adaptation and working environment

The problem of optimal matching between the individual and the working environment is a critical area for the improvement of health. Ergonomics and knowledge of psycho-physiological profiles of different jobs should be promoted, including considerations of the effects of light, noise, etc., as well as of the impact of information technology on job-profiles, with special reference to employment of handicapped persons.

2. Reproduction, growth and ageing

Congenital abnormalities and infant mortality

Improvement of methods for prenatal detection of congenital abnormalities and for screening the newborn for congenital metabolic or other physiological defects requires further R, D&D efforts. Preventive studies should be directed to better identification of potential risks including embryotoxic effects and deficiencies that might increase their incidence.

The correlation of infant mortality and morbidity with perinatal conditions should be investigated. Research into infant physiology defence mechanisms and their activation should be promoted.

Growth

Birth cohort studies should be encouraged to monitor personal, environmental and social factors influencing physical and intellectual development. Particular attention in cross-cultural studies should be paid to diet and nutrition in childhood and early life. Nutritional needs in late adult life are ill-defined. It is important that caloric, fat and protein intake should be examined in relation to prevailing health status, and attempts made to define optimal nutritional patterns.

The Elderly

The problems of chronic brain dysfunction, and of sensorial (auditory and visual) and motor handicaps in the elderly should be intensively explored. Preventive measures, as well as early diagnostic ones, and both medical and surgical treatments, including natural or artificial implants, should be given a very high priority.

Physiological studies should also be promoted in order to understand better the characteristics of the biochemical, physiological and regulatory interplay in the elderly.

3. Personal environment

Accidents

Epidemiological studies of accidents at home and on the roads are required to assess both human and technological factors involved. Driving ability should be studied with consideration to possible effects of prescribed drugs.

For accidents at work, research is necessary on the application of the principles of integrated safety on machine design and use, materials choice and work organization. Special attention should be given to certain industries e.g. construction, and certain groups of workers e.g. young, migrants, sub-contractors.

Research on the limitation of consequences of radiation accidents remains an area of high priority. In this respect, local irradiations of limited importance - which happen rather frequently among workers - are to be given more attention.

Exposures

Research into the effects of ionizing radiation on man and his environment must consider somatic and genetic effects, risk evaluation and optimization of protection as well as improved dosimetry, taking into consideration aspects of occupational protection, that of the general public and that of patients undergoing radiological examination. In this last case special attempts must be made to identify alternative methods to reduce radiation exposure in diagnostic procedures (see also the objective "Developing nuclear fission energy, particularly its safety aspects".

The increasing use of optical and non-optical non-ionizing radiations (ultrasounds, ultraviolet light, microwaves, laser, radiowaves, etc.) should be monitored for possible damage or long-term effects. Reliable dosimetry needs to be developed.

A strategy to clear the backlog of chemical substances for which toxicological information is lacking should be progressively developed. New methods of toxicity testing and bioassays need to be developed and standardized (see also the objective "Protection of the environment and preventing pollution").

Dust, noise, vibrations and temperature stress are typical pollutants of mining, steel and other heavy industries and remain research priorities.

Biotechnologies are likely to become an important aspect in industrial activities before the end of the century. It is important that investigation of potential risks and ways to detect, prevent or contain them be encouraged (see also the objective "Promoting and developing new technologies ; biotechnology").

Surveillance of workers and public exposed to risks requires the development of information systems. Research and development of data sources for health research purposes is a high priority.

4. Health technology

Diagnosis

Non-invasive methods for earlier detection of altered function, biological monitoring, and methods for measurement of regulatory factors and markers should be developed. Cell cultures, genetic markers, membrane transport studies, advanced enzymology, immunochemistry and cytochemistry, etc. should be developed in clinical practice.

Recent developments in imaging techniques should be monitored for their clinical effectiveness.

Advanced computer methods and telematics should be incorporated into clinical procedures.

Treatment

Receptors biochemistry should be encouraged including the development of specific carriers for active molecules by advanced immune techniques. Moreover, the development of in-vitro pharmacological systems acceptable by all or most of the Member States and the development of new - particularly preventive - drugs requiring significant R, D&D expenditure and having important influence on the overall cost of health care, should also be encouraged (see also the objective "Promoting and developing new technologies ; biotechnology").

Genetic engineering should be exploited for production of protein-molecules.

Plasma and blood treatment for extracorporeal removal of endogenous or exogenous noxious substances by combining biological and physico-chemical methods should be further developed.

Combination of surgical, physical and pharmacological methods for selective destruction of lesions should be promoted and evaluated.

Further development of treatment and prognosis methods of the effects of local and total body irradiation is necessary.

Research should be co-ordinated in the area of organ transplants, relevant immunological research, artificial organs and tissues, including hybrid techniques and biocompatible materials.

5. Health care

Delivery

Disabling common conditions, e.g. emotional disorders, rheumatic disease, are high priority problems.

The assessment of benefits of preventive methods, clinical procedures, and new medical technologies should be carried out through controlled trials.

Research on screening and health surveillance with methods for the early diagnosis and detection of deterioration in performance must be developed.

Organization

Research into resource distribution, utilisation and effectiveness should be encouraged in conjunction with formal cost assessment. Comparative studies between Member States on resource allocation and planning should be undertaken. The information requirements for health service management should be defined and health information systems designed and developed.

6. Health promotion

Research into methods of promoting healthy lifestyles should be pursued with particular reference to high risk groups, e.g. migrants, and evaluation of techniques and programmes undertaken. Campaigns to educate public attitudes, expectations and use of health services should be developed and evaluated.

6.2. PROTECTING THE ENVIRONMENT AND PREVENTING POLLUTION

INTRODUCTION

The basic objectives of the environmental policy [1] are to preserve health, human life and living systems necessary to man, to safeguard plant and animal life and the natural environment as a whole and generally to improve the quality of life.

Up to now, the approach to environmental management has basically been a reactive one, with problems generally being tackled in an ad hoc manner as and when they emerged, or rather as they became obviously urgent. It is now generally recognized that prevention would be more appropriate, more effective and less costly than cure. Naturally a new approach of this kind presupposes a change of emphasis in the R, D&D carried out in support of the environment policy. Very briefly, the adjustments needed may be summarized as follows :

- Prevention

Environment R, D&D should back up the preventive approach to environment management. This means that the various factors affecting the environment have to be taken into consideration at the earliest possible stage and at the highest possible decision making level. R&D support is essential for the identification and evaluation of hazards of physical (ionizing and non-ionizing radiation, etc.), chemical or biological origin and for the design and implementation of policies and plans intended to protect the environment.

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[1] Action Programme of the European Communities on the Environment (1982-1986) (draft being revised) - COM(81)626 final, 4.11.1981.

- Long lead time research programmes

In addition to research on tackling problems that already exist or will come up in the medium term, long lead time research projects are essential. The aim will be to improve the understanding of fundamental environmental and ecological processes. They will have to examine in particular climatic factors which, depending on the way they interact, may help or hinder human activities. Long lead time research will help to give decisionmakers a better awareness of future problems and trends.

SPECIFIC OBJECTIVES

Since most human activities have an impact on the environment, the environment objective is closely linked to all the other objectives in the framework programme (such as agriculture, industry, energy, developing countries, raw materials, etc.). Consequently the range of problems calling for environmental R, D&D activities is extremely wide.

Environmental factors are not confined within national boundaries and most of them are common to several countries. Extensive cooperation at Community level is therefore essential, especially in view of the limited resources (both human and financial) available to each member country for research on the environment. The value of this cooperation is even more obvious for long lead time research, which is generally costly and is of interest to all the Member States and even to other countries.

The specific objectives for Community research are outlined below :

1. Research in support of environmental management

This covers three fields : pollution, resources and the interaction between man and the environment. In each of these fields more specific objectives can be defined.

Pollution control concentrates on aspects such as pollution sources, pathways, ecological and health effects, reduction and prevention. The specific objectives are, for example :

- effects of chemical products and their monitoring,
- behaviour and monitoring of radionucleides in various ecosystems,
- evaluation of pollution, development of pollution abatement methods and clean technologies for selected industries, in particular those concerned with energy (mines, coal combustion and conversion, vehicles),
- accumulation of CO_2 in the atmosphere and its climatic implications,
- impact of human activities on the stratosphere,
- effects of atmospheric pollution on terrestrial ecosystems, especially acid rain,

- processing, storage and reduction in volume of toxic and dangerous waste,

- exhaustion and pollution of the water table, pollution of fresh water and coastal ecosystems and marine pollution by hydrocarbons,

- impact on the environment of new technologies such as biotechnology,

- abatement and control of noise pollution and vibrations.

The preservation of resources in the natural environment is very closely tied up with the objectives of the agriculture and fisheries sections. More specific objectives include :

- preservation of the diversity of living species and genetic resources,

- prevention of soil degradation and the reduction in arable areas,

- efficient forestry working,

- rational use of pesticides and fertilizers,

- preservation of ocean resources.

As regards man/environment interactions, Community R, D&D will endeavour to bring together activities of a multidisciplinary nature and to assess the overall interaction between man and his surroundings.

Priority will be given to research on :

- the effects of urban encroachment, tourism and intensive agriculture,

- the effects of population increases,

- the loss of cultural heritage.

2. Overall understanding of environmental problems

The Community R, D&D work should give an overall picture in the following fields :

- improved understanding of the fundamental processes in ecosystems,

- improved knowledge of climatic mechanisms and the influence of human activities on climate,

- evaluation of the impact of climatic changes on water and agricultural resources (erosion, desertification),

- public awareness of environmental problems and management of information on environmental protection,

- development at Community level of impact assessment techniques, modelling methods, etc.

Over and above these specific objectives, it is essential to strengthen the European position as regards instruments for measuring and monitoring environmental parameters (see the objective "Improving and developing new techniques and products for the conventional industries").

GOAL 6 : IMPROVING LIVING AND WORKING CONDITIONS

Approximate breakdown between the specific objectives

6.1. Improving safety and protecting health

Specific objectives	%
- Human adaptation	10
- Reproduction, growth and ageing	5
- Personal environment	25
- Health technology	40
- Health care	15
- Health promotion	3

6.2. PROTECTING THE ENVIRONMENT AND PREVENTING POLLUTION

Specific objectives		%
- Environmental management		70
. reduction and prevention of pollution	40	
. preservation of natural resources	25	
. interactions between man and the environment	5	
- Overall understanding of environmental problems processes of the ecosystem and climatic mechanisms ; information for and attitude of the general public ; impact assessement techniques, etc.		30

To reach the necessary level of effectiveness at Community level, the funds to be devoted to this goal for 1984-1987 should be at least 270million ECU (in constant 1982 values) broken down as follows :

- improving safety and protecting health 110 million ECU
- protecting the environment 160 million ECU

It should be noted (see page 70) that further scientific and technical objectives will need to be taken into consideration in the future and will have to have appropriate resources allocated to them.

Later addendum on:

Goal n°6. "Improving living and working conditions" - 270 MioECUs, increased to 385 mioECUs.

As indicated above, the development of nuclear fission energy included research activities more closely related to the goal "Improving Living and Working Conditions". This goal is thus to benefit from the transfer of 80 MioECUs from the energy goal. This goal has also been subjected to a reexamination on the basis of discussions in the Council as well as subsequent deliberations, particularly within specialised scientific committees.

Research into natural catastrophes, covering aspects of forecasting them, preventing them and mitigating their effects is a subject of common interest where the Community dimension will, by bringing research together, and through the follow on effect of a mobilising programme, make possible an increase in knowledge and hence a reduction in the human and material consequences of these natural phenomena (flooding and drought, earthquakes, volcanic eruptions, etc..). This sort of research will be basically split between the two objectives relating to this goal.

It might also be expedient to increase the importance given to healthcare in the objective "Improving safety and protecting health" and not to reduce the level of research in absolute terms in comparison with the current level.

In objective "Protecting the environment", the problem of the destruction of forests as a result of acid rain - already cited in the Commission's proposal - should receive a higher priority.

These considerations have encouraged the Commission to set the following proposed expenditure against these two objectives :

(Addendum continued)

Improving safety and protecting health	190 MioECUs
Protection of the environment	195 MioECUs
Goal n°6 : Improving Living and Working Conditions"	385 MioECUs instead of 270

7. IMPROVING THE EFFICACY OF THE COMMUNITY'S SCIENTIFIC AND TECHNICAL POTENTIAL

INTRODUCTION

This new form of action, which during the years 1983 and 1984 is to be the subject of an experimental exercise intended to try out the ways and means of intervention which are specific to the action, corresponds to one of the major goals of the framework programme and needs to be adopted as one of the bases of the common strategy.

Firstly, it is directly designed to strengthen the scientific competitiveness of the Community and thereby has a more or less direct impact on increasing economic competitiveness, improving safety factors and developing the dialogue between the Community and non-member countries.

Secondly, within the framework programme it is an essential complement to the programmed activities if the element of flexibility, speed and "edge" so necessary to the common R&D strategy is to be retained. Because of its very nature, this activity occupies a special place in the framework programme. Since its aim is to increase the effectiveness of R&D in the Community, the stimulation scheme concentrates more on providing support for research teams and different forms of R&D (multidisciplinary and multinational) than developing research and development activities. Consequently it consists of a number of activities that cannot be planned in advance.

The stimulation action thus

- fills out the range of measures already taken at national, international and Community level to sustain the competitiveness of European science and technology,

- contributes whenever necessary, a supplement to the Community's medium term R, D&D programmes in the form of "unrestricted" action.

In order to break down the isolation of monodisciplinary research, open it up to the Community multinational dimension, ensure cross fertilization, take full advantage of promising breakthroughs or respond to unforeseen requirements, there must be a capability to react to new situations as and when they emerge. The weakness of the factors making for mobility, the shortage of jobs for young graduates and the inadequacy of structures to cope with the changes in science and technology are all handicaps that have to be overcome.

To judge from an analysis of structural and human factors limiting the efficacy of European R&D in fields where it directly affects the chances of attaining the Community's scientific and technical objectives, the most that can be done in advance in the way of stimulating efficacy is to determine the courses of action that could reduce or abolish these constraints and to estimate the resources required for that purpose.

The choice of the "partners" who will put the stimulation scheme into effect by conducting certain R&D work must be based on an assessment of their quality and potential and the likelihood that their work will genuinely help to improve efficacy in the type of R&D concerned. This evaluation must be made on a case-by-case basis by the scientific and technical Community itself in the light of the offers of cooperation received.

The application of these principles has led to the preparation of an outline plan of stimulation, summarised below [1] which aims to improve the efficacy of R&D capabilities whilst corresponding to the scientific and technical goals and objectives in the general framework programme for the period 1984-1987.

Finally, and taking account of the evaluation of methodology which the Commission will undertake at the end of the first year of the experimental phase, the Community Institutions will be required to come to a decision on the outline plan so that the action, whose "value and opportuneness" were recognised at the Council's meeting of 30 June 1982, can, from 1985 onwards be developed with the appropriate bases and funds.

FIELDS OF ACTION

Several dozen studies (including 36 prospective studies conducted by the FAST team), more than 30 meetings (conferences, seminars, panels of experts) held by or under the auspices of the general advisory committees (CERD, CORDI), numerous discussions at national and international level (ESF, Solvay Institutes, NATO, NAS [2]), the work on comparing national policies (COPOL) and on preparing plans for the various goals of the framework programme have yielded the following results :

- they have identified factors restricting the efficacy of European R&D systems and the way they measure up to today's requirements ;

- they have made it possible to evaluate the limits to national, international and Community activites that have already been carried out to stimulate this efficacy and reduce the mismatch with requirements ;

- they have identified a vast number of fields, both multisectoral and multidisciplinary, which call for suitable support and a multinational dimension in order to bring about better scientific and technical development.

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[1] The full version of the outline plan is the equivalent of the "theme plans" preapred for the various basic options selected for the framework programme (see the list of these plans in Annex II).

[2] ESF : European Science Foundation
NATO : North Atlantic Treaty Organization
NAS : National Academy of Science (USA)

Bearing in mind the other six goals in the framework programme, there are substantial stimulation requirements in many areas. In an ambitious and pragmatic approach, the Commission is first focussing on a few of these areas in the light of an analysis of the scientific and technical importance of each of them, the efficacy of the R&D conducted in it, how closely it is inter-related with several other scientific and technical sectors, its usefulness in the light of the goals of the framework programme and the prospects of substantial progress.

Finally, partial overlaps with Community R, D&D programmes are anticipated so as to make it possible, whenever this seems necessary, to bring a "stimulation dimension" to sectors covered by medium term Community programmes.

These choices will be adapted and supplemented as the stimulation activities are developed, bearing in mind requests from the scientific and technical worlds themselves.

Frequently overlapping and often dependent on the development of common conceptual tools, the areas described differ essentially in the level of knowledge concerned and in how remote they are from practical applications.

- Science of complex systems

  A vast area in which the development of basic knowledge is of interest to numerous scientific and technical sectors and disciplines. Some components are of particular social and economic interest. The more specific incentive activities will be concentrated on these and will essentially be designed to strengthen the links between the "basic" research, "applied" research and "development" parts of the scientific and technical activity. The following will be covered : basic biological research and its developments, earth atmosphere interfaces, chemistry (especially fine chemicals and basic combustion phenomena), the earth sciences and optics.

- Information and communication sciences

  There are already numerous Community projects under way in this field and a major R&D programme has been proposed (ESPRIT) ; all these activities also require conceptual capacity to be built up by improving exchanges between basic researchers and activating the research/applications interfaces through collaboration between researchers and users.

- Oceanography

  A very promising R&D field of a typically multidisciplinary nature in which the indispensable cross fertilization of disciplines and R&D activities can be improved through the stimulation scheme. Three areas can be considered here (coastal zones, the great deeps and the interface between ocean and atmosphere) and stimulation measures are needed to strengthen and supplement the national or international R&D programmes that are already in progress or will be developed.

- Space

Space is an exceptional laboratory environment in which substantial scientific progress can be made (especially in biology and the study of processes taking place at the heart of matter - formation of materials in conditions of micro-gravity) ; this can be fostered by stimulation measures to assist R&D activities on the ground in support of in-flight experiments and to help breaksdown the scientific and technical isolation of certain teams in the Community.

- Surface chemistry and physics

This field has a close relationship to the sciences of complex systems, and can lead to more direct applications of any advances in basic knowledge. This is particularly true of catalysis, surface exchange and adhesion phenomena. Suitable stimulation measures will help overcome the difficulties resulting from the scattered location of teams, their often inadequate size or poor communications between R&D disciplines.

- Scientific instrumentation

This sector is experiencing substantial economic growth and a greater R&D effort of an appropriate nature should be encouraged so as to strengthen its scientific and technical bases, since it is both of importance for technical progress and an major industrial market in its own right. The stimulation measures should be designed to provide support for basic R&D work or the development of new instruments involving close cooperation between different teams. Preference will be given to instrumentation sectors relevant to the fields selected for the stimulation scheme.

- Science of the structure of composite materials

This field is of great importance for advanced technologies, but an element of empiricism is sometimes a drag on scientific and technical progress. Apart from the need to develop genuine joint R&D programmes, it is also necessary to encourage greater effectiveness (especially in the areas of metallic composites and biomaterials) by strengthening basic multidisciplinary research combined with experiments.

To ensure that the decisions taken do not rule out the capacity to react to unforeseen situations, some of the funds available for the stimulation scheme would be set aside to be spent on any other field in which a requirement might emerge.

Forms of aid

The kind of difficulties to be faced in these fields derive from the operational arrangements which the Commission intends to test and perfect in 1983 and 1984. The stimulation activity in the period 1985-1987 should basically take the four forms tested in 1983-1984 : subsidies, research allocations, laboratory twinning contracts and operations contracts. There will be two

types of action : incentive operations to promote mobility, cooperation and new avenues of R&D, and operations with a specific target designed to mobilize available resources in order to attain a specific result.

Funds required

In view of the requirements to be met and the threshold of effectiveness for attainment of the desired result (estimated in comparison with the level of national and international aid of the same type), it has been concluded that it is necessary to earmark 5% of the "total amount of Community financial resources for science and technology" : this is an objective to be attained at the end of the 1984-1987 period.

Later addendum on:

Goal n°7. "Improving the efficacy of the Community's scientific and technical potential"-85 MioEcus

Certain delegations suggested that the results of the experimental period of the stimulation activity should be awaited before allocating any major sums to it. The Commission would mention that the experimental period 1983-1984 is exclusively concerned with the operational procedures of implementing the action and not the principle of it, which has already been approved by the Council.

Since preparatory studies have led the Commission to the conclusion that 5% of the finance to be set aside for scientific and technical activities at the community level should be reserved for non programmed stimulation actions, this proportion has been adopted as an objective to be achieved by the end of the period. This is why the Commission proposes gradually to increase the financial resources allocated to this option and to provide for a total sum of 85 MioECUs for the period 1984-1987.

If the conclusions arising from the experimental period lead to a fundamental revision of some of the intervention methods anticipated and to a modification of the programme timetable of development envisaged for this action the financial resources which would consequently become available during the period 1984-1987 could be transferred to other research activities.

B-2 HORIZONTAL ACTIVITIES

The adoption of an overall framework programme implies, as a corollary, that the Community pay special attention to "horizontal activities" which are of scientific and technical interest :

- forecasting studies (a FAST II programme),
- the dissemination of scientific and technical information and knowledge,
- protecting inventions,
- exploiting R,D&D results,
- finally, the continuous evaluation of R,D&D results and their use.

Taken together these activities are of considerable value. Since they form, directly or indirectly, one of the keys to the effectiveness of Community R,D&D they need to be systematically sustained.

By virtue of their "horizontal" nature they are the subject of specific proposals by the Commission[1] which will go together with and act as supporting measures for this framework programme proposal.

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The minimum threshold of resources for 1984-1987 above which these activities are likely to be both adequate and effective is 110 MioECUs (at 1982 constant prices). This sum includes activities directed towards utilising the results of Community R,D&D, for which a special system of financing is proposed by the Commission [1].

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(1) See documents : "Promoting the utilization of Community-sponsored R&D" and "Community plan of action relating to the evaluation of Community R&D programmes".

Later addendum on:

HORIZONTAL ACTIVITIES - 110 MioECUs, reduced to 90 MioECUs.

In response to certain questions posed during discussion of the Framework Programme, the Commission would like to make it clear that scientific and technical activities of a horizontal nature include :

- the FAST programme,
- preparatory studies for future programmes,
- promoting the utilisation of results (taken in the wider sense which covers activities aimed at protecting, disseminating and exploiting research results as well as licence concessions on inventions),
- training activities together with grants and courses,
- ongoing evaluation of R, D&D results and their utilisation,

In undertaking a rigorous analysis of these horizontal actions in order to eliminate those which do not really possess an R, D&D element, the Commission has come to the conclusion that the resources needed to undertake these activities could be reduced from 110 to 90 MioECUs.

TABLE SUMMARISING THE OBJECTIVES AND THE AMOUNTS CONSIDERED NECESSARY TO ACHIEVE THEM

	MioECUs[1]	%
1. Promoting agricultural competitiveness	**130**	**3,5**
- developing agricultural productivity and improving products : agriculture	115	
fisheries	15	
2. Promoting industrial competitiveness	**1060**	**28,2**
- removing and reducing impediments	30	
- new techniques and products for the conventional industries	350	
- new technologies	680	
3. Improving the management of raw materials	**80**	**2,1**
4. Improving the management of energy resources	**1770**	**47,2**
- developing nuclear fission energy	460	
- controlled thermonuclear fusion	480	
- developing renewable energy sources	310	
- rational use of energy	520	
5. Reinforcing development aid	**150**	**4,0**
6. Improving living and working conditions	**385**	**10,3**
- improving safety and protecting health	190	
- protecting the environment	195	
7. Improving the efficacy of the Community's scientific and technical potential	**85**	**2,3[2]**
- Horizontal activities	**90**	**2,4**
	3750	**100,0**

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[1] in ECUs at 1982 constant values

[2] corresponds to 5% by the end of the period.